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Development of Machine Tools in New England

By GUY HUBBARD

The first of a series of articles—Original settlers men of mechanical ability—Difficulty of transportation—Genealogy of some famous establishments

WHILE much has been written about the history of American machine tools but little has been told about how and why they came into being and of the early efforts of the tool builders to establish interchangeable manufacture.

The State of Vermont, and more especially the town of Windsor and the region contiguous thereto, has had a very large part in the development of American machine tools. That Yankee ingenuity was responsible, not only for much of our automatic machinery but for our system of interchangeable manufacture as well, will be evidenced by the series of articles begun in this issue.

The articles have been prepared by Guy Hubbard, a native of Vermont and a great-nephew of Asahel Hubbard who was connected with the concern that, more than any other, was responsible for the early development of American machine tools and the interchangeable system.

While, no doubt, the work undertaken by Mr. Hubbard has been a labor of love on his part, he is to be congratulated on the results of his untiring energy in bringing to light facts, some of which were hidden in old records, while others existed only in the memories of descendents of the early mechanics.

FAR DISTANT from other centers of production, and from the sources of raw material; with apparent disadvantages of transportation and with no apparent advantages in regard to labor—the village of Windsor (see Fig. 1) seems to have been for years guilty of deliberately violating the laws of economics. Not only is this village in the upper valley of the Connecticut, notable today in the engineering field for its automatic machinery, but the surrounding region has enjoyed more than a century of remarkable history in invention and mechanics. The importance of this history may be realized by considering Professor Joseph W. Roe's "English and American Tool Builders." This broad work covers the development of machine tools from the boring of Watt's first steam-engine cylinder by Smeaton at the Carron Iron Works in 1769, down to the production tools in use in 1915; yet not only is a full chapter devoted to the Windsor industries, but elsewhere in the book numerous references are made to the mechanical developments emanating from the neighborhood of this Vermont village. While we must admit that England, with her Maudslay, her Clement, her Nasmyth and her Whitworth, was the birthplace of the machine-tool industry, it cannot be denied that New England, the birthplace of mechanics whose names will ever be remembered by engineers, gave to the world the interchangeable, or American system of manufacture, won leadership both in the refinement of the older machine tools and in the creation of new ones. This statement will be better appreciated by a study of the genealogical chart shown in Fig. 2 and the map in Fig. 3.

While dealing primarily with the apparently narrow subject of the industries of a country village, the story is not one of mere local interest but one of the developments of American manufacturers, giving some of the history of such industries and inventive mechanics whose influence has spread far beyond the shadow of Mount Ascutney to further industrial progress, not only in America but beyond the seas. For instance, New Haven had the famous gunsmith and inventor, Eli Whitney, but Windsor trained Benjamin Tyler Henry, who developed the Winchester rifle at New Haven; while it is true that Hartford had Col. Samuel Colt, yet from Windsor came Richard S. Lawrence, who became its leading manufacturer; Providence had Joseph R. Brown, but Windsor gave Frederick W. Howe to Providence where he succeeded Mr. Brown as a leading mechanical engineer.

In August 1764, the first settler of Windsor, Captain Steele Smith, removed with his family from Farmington in the mechanical colony of Connecticut and made his home in the Vermont hills.

Shortly after the settlement of the town two dams about two hundred yards apart were built near the

GENEALOGY OF THE MACHINE INDUSTRIES OF WINDSOR, VERMONT

Compiled by Geo. Herbert B. Walker, Vermont, 1922

SOURCES

As name WINDSOR indicates, many of the early settlers were CONNECTICUT YANKEES from the HARTFORD DISTRICT.

TINMOUTH IRON WORKS (Near Rutland, Vt.), 1785-1820.
WINDSOR & PLYMOUTH, ASCUTNEY IRON CO., 1836-1872.
Tyson's Furnace, Plymouth, Vt.
Isaac Tyson, Jr., Builder and Proprietor. (Well known Baltimorean.)
Chemist and Manager of Copperas Works at Strafford, Vt.)
Francis Draper ..... Superintendent of Furnace

DEWITT CLINTON was Governor of New York and builder of the Erie Canal. He came to Windsor, Vt., in 1827 to assist in the Connecticut River Project, and at that time became interested in the Rotary Pump.

CAPTAIN SAMUEL MOREY, born at Hebron, Conn., in 1762, built and operated on the Connecticut River near Fairlee, Vt., a successful Steamboat in 1793.

THOMAS BLANCHARD, born at Sutton, Mass., in 1788, was inventor of Gunstock Lathe. In 1829, he built at Springfield, Mass., the steamboat "Vermont" and in the fall of that year navigated it from Hartford, Conn., to Windsor, Vt., for the Conn. River Valley Steamboat Co.

JOHN M. COOPER was an inventor from Guildhall, Vt.

ASAHEL HUBBARD, born at Meriden, Conn., in 1787, came to Windsor, Vt., in 1800, and learned trade there.

JABEZ PROCTOR was a Mill Owner of Proctorsville, Vt.

NICANOR KENDALL, born at West Windsor, Vt., in 1807, learned trade of Gunsmith there in a shop of Asa Story. Kendall was a son-in-law of Asahel Hubbard.

COLMAN S. HUBBARD, son of Asahel Hubbard, learned his trade under his father and Nicanor Kendall.

CARLOS COOLIDGE, born at Windsor, Vt., in 1792, graduated at Middlebury College and became a Windsor lawyer.

RICHARD S. LAWRENCE, born at Chester, Vt., in 1817, learned Machinist and Gunsmith trades at North Watertown, N. Y. Came to Windsor, Vt., in 1838.

BENJAMIN TYLER HENRY, born at Claremont, N. H., in 1821, learned trade there at shop of J. B. Ripley & Co.

SAMUEL E. ROBBINS, born at Boston, in 1810, was a wealthy Lumber Merchant of Boston and Bangor, Maine.

SEWELL F. BELKNAP, born on farm near West Dummerston, Vt., in 1812, rose from laborer to Railway Contractor, and before death at thirty-six built Boston, Portsmouth & Saco; Fitchburg; and Central Vermont Railways.

WARREN CURRIER, born at Walpole, N. H., in 1817, studied Law at Windsor, Vt., and became an attorney there.

LEMUEL HEDGE, born at Windsor, Vt., in 1786, became a Cabinet Maker and Mechanic there. Invented Paper Ruling Machine, 1817; Engine for Dividing Scales, 1827.

COURTLANDT C. PALMER, born at Stonington, Conn., in 1800, was a leading New York Hardware Merchant and backer of the inventors Walter Hunt and Louis Jennings.

CHRISTIAN SHARPS, born at Washington, N. J., in 1811, learned Gunsmith trade in local shops. He invented his famous Breech Loading Rifle at Cincinnati, in 1848, conceiving his idea from the Hall Breech loader of 1811.

FREDERICK W. HOWE, born at Danvers, Mass., in 1822, learned Machine Design and Construction under Zeba Gay of SILVER & GAY COMPANY, North Chelmsford, Mass.

HENRY D. STONE, born at Plainfield, N. H., in 1815, learned trade of Patternmaker at Woodstock, Vermont.

DANIEL B. WESSON, born at Worcester, Mass., in 1825, was Gunsmith and Inventor for George Leonard, Jr., of Shrewsbury, Mass., maker of Revolving Hammer Pistols.

EDWIN CLARK, was from Grover & Baker Sewing Machine Co.

GEORGE A. FAIRFIELD, born at Lansingburg, N. Y., in 1834, learned Machinist's trade under Lucius and Ira Dimmock, builders of Textile Machinery at Northampton, Mass.

CHARLES E. BILLINGS, born at Weathersfield, Vt., in 1835, learned Blacksmithing under his father at Windsor, Vt.

GEORGE W. HUBBARD, nephew of Asahel Hubbard, was born at Windsor, Vt., in 1836, and studied Engineering at Norwich University, Norwich, Vermont.

LAMSON & GOODNOW CUTLERY WORKS, 1847.
Shelburne Falls, Mass.
Ebenezer G. Lamson ..... Founder and President.
(Mr. E. G. Lamson was born at Stirling, Mass., in 1814.)
Abel F. Goodnow ..... Treasurer
B. Buchanan Yale ..... Sales Agent

EASTBURNE E. LAMSON, born at Shelburne Falls, Mass., in 1843, was a student at Brown University.

LIEUT. RALPH H. LAMSON, nephew of E. G. Lamson, was an officer in United States Navy during Civil War.

GENERAL HIRAM BERDAN, born at Phelps, N. Y., in 1824, was a well-known Mechanical Engineer and was Commander of famous Berdan Sharpshooters from 1861 to 1864.

DESCENT LINE OF THE WINDSOR INDUSTRIES

YANKEE INGENUITY—NATIVE BORN—WATERPOWER PATENTS

By Inclination and of Necessity many of the early inhabitants of Windsor became Millwrights, Gunsmiths and Inventors. From Vermont Timber and their Native Iron, with the help of ample Water Power, and under the protection of the United States Patents, these men, more than a century ago, began to manufacture in quantities their novel and practical Devices.

In an attempt to solve their Transportation Problem, and to more fully develop their Water Powers, they organized:

THE CONNECTICUT RIVER COMPANY, 1824-1828.
THE CONN. RIVER VALLEY STEAMBOAT CO., 1828-1832.
Canalization of River—Development of Steamboats.
Gov. DeWitt Clinton ..... Promoter and Advisor.
Capt. Samuel Morey ..... Canal Engineer.
Thomas Blanchard ..... Steamboat Builder and Pilot.
THE ASCUTNEY MILL DAM COMPANY, 1833-
Construction of Stone Dams on Mill Brook.
The following Chain of Industries resulted:

THE AMERICAN HYDRAULIC COMPANY, 1828-1829.
THE NATIONAL HYDRAULIC COMPANY, 1829-1839.
Rotary Pumps and Fire Engines—Underhammer Guns.
John M. Cooper ..... Inventor of Rotative Piston.
Asahel Hubbard ..... Inventor of Rotary Pump.
Jabez Proctor ..... Financial Backer and Manager.
Nicanor Kendall ..... Gunsmith and Inventor.
Colman S. Hubbard ..... Machinist and Gunsmith.
Gov. DeWitt Clinton ..... Promoter of Rotary Pump.
Carlos Coolidge ..... Patent Attorney.

N. KENDALL & COMPANY, 1839-1843.
KENDALL & LAWRENCE, 1843-1844.
Hubbard's Rotary Pumps—Kendall's Underhammer Guns.
Nicanor Kendall ..... Gunsmith and Proprietor.
Richard S. Lawrence ..... Gunsmith and Designer.
Benjamin Tyler Henry ..... Gunsmith and Inventor.

ROBBINS, KENDALL & LAWRENCE, 1844-1849.
THE WINDSOR CAR & RIFLE COMPANY, 1849-1850.
THE ROBBINS & LAWRENCE COMPANY, 1850-1856.
THE VERMONT ARMS COMPANY, 1856-1858.
"Windsor" U. S. Rifles—Railway Cars—Sharps Rifles—Jennings Repeating Rifles—Revolving Hammer Pistols—British Enfield Rifles—Gun Machinery and Machine Tools—Single and Double Thread Sewing Machines.
Samuel E. Robbins ..... Manager and President, 1844-56.
Nicanor Kendall ..... Superintendent (Retired in 1849).
Richard S. Lawrence ..... Mechanical Engineer, 1844-56.
Sewel S. Belknap ..... Silent Partner (Died in 1849).
Warren Currier ..... Incorporator and President.
Lemuel Hedge ..... Iventor of Band Saw in 1849.
Courtlandt C. Palmer ..... Promoter of Jennings Rifle.
Christian Sharps ..... Inventor of Sharps Rifle.
Frederick W. Howe ..... Designer and Superintendent.
Henry D. Stone ..... Superintendent and Inventor.
Benjamin Tyler Henry ..... Gunsmith and Inventor.
Daniel B. Wesson ..... Expert on Revolving Pistol.
Francis Draper ..... Superintendent of Foundry.
Edwin Clark ..... Inventor of Sewing Machine.
Carlos Coolidge ..... Patent Attorney.
George A. Fairfield ..... Gunsmith and Machinist.
Charles E. Billings ..... Apprentice and Die Sinker.
George W. Hubbard ..... Apprentice Draftsman.

RELATIONSHIPS

FALES & JENKS MACHINE COMPANY, Pawtucket, R. I.
David Fales and Alvin Jenks formed a partnership at Central Falls, R. I., in 1830, and in 1833, purchased the R. I. patent rights on the Hubbard Rotary Pump. This company still manufactures it, almost unchanged.

ORIGINAL CITY WATER WORKS OF ST. LOUIS, MO.
Asahel Hubbard built and installed first pump in 1830.

Father of Senator Redfield Proctor, who was Secretary of War, Governor of Vt., and founder of Vt. Marble Co.

WHITNEY ARMS COMPANY, Whitneyville, Conn.
Colman Hubbard ..... Secretary, 1860-1865.

ROBBINS & LAWRENCE, 1851-1856.
SHARPS RIFLE MANUFACTURING COMPANY, 1851-1875.
Hartford, Conn.
Sharps Rifles—Enfield Rifles—Machine Tools—Gun Machinery—Weed Sewing Machines.
Richard S. Lawrence ..... Master Armorer, 1852-1872.
(Aided C. M. Spencer to perfect Spencer Repeating Rifle.)
Christian Sharps ..... Inventor and Superintendent.
(Also Proprietor of SHARPS & HANKINS ARMORY, Phila.)
Hezekiah Conant ..... Draftsman and Inventor.
(Taught C. M. Spencer drafting, and with him joint inventor of Willimantic Spooler, first machine built by PRATT & WHITNEY, Founder of CONANT THREAD COMPANY.)
Rollin White ..... Gunsmith and Inventor.
(Original Inventor of SMITH & WESSON REVOLVER.)
Joseph Dana Alvord ..... Contractor.
(Became leading Contractor at WHEELER & WILSON CO.)

After 1875 the Sharps Plant became:
THE WEED SEWING MACHINE COMPANY, 1875-1893.
Weed Sewing Machines—First Spencer Automatic Screw Machines—Col. Albert Pope's First Bicycles.
George A. Fairfield ..... Founder and President.
THE POPE MANUFACTURING COMPANY, 1893-1914.
Columbia Bicycles—Pope-Hartford Automobiles.
Col. Albert Pope ..... Founder and President.
George A. Fairfield ..... Director.
Ned Lawrence ..... Superintendent.
(Son of Richard S. Lawrence.)
PRATT & WHITNEY COMPANY, Hartford, Conn.
This company, whose origin was influenced by Sharps Company, purchased the old Sharps Plant in 1914.

Howe's Plain Miller became LINCOLN MILLING MACHINE.

ROYAL ARMORY OF GREAT BRITAIN, Enfield Lock, England.
Robbins & Lawrence at Windsor, built nearly all the Mechanical Equipment and first 25,000 Interchangeable Army Rifles for British Government, 1854-1856.

President of MISSOURI CAR & FOUNDRY CO., 1872-1876.

E. A. STEARNS & CO., Brattleboro, Vt., 1830-1868
(Now part of STANLEY RULE & LEVEL CO., New Britain.)
Hedge Dividing Engines—Hedge Patent Jointed Rules.
Lemuel Hedge ..... Inventor and Founder.

THE PROVIDENCE TOOL CO., (Now RHODE ISLAND TOOL CO.)
Frederick W. Howe ..... Superintendent, 1861-1865.
ELIAS HOWE SEWING MACHINE CO., Bridgeport, Conn.
Frederick W. Howe ..... Superintendent, 1865-1868.
BROWN & SHARPE MFG. CO., Providence, R. I.
Frederick W. Howe ..... Incorporator and Supt., 1868-1873.
(As Consulting Engineer developed Wilcox & Gibbs Sewing Machine and Goodyear Welt Sewing Machinery.)
Henry M. Leland served under Mr. Howe about 1870.

SMITH & WESSON, Norwich, Connecticut.
B. Tyler Henry ..... Gunsmith and Inventor, 1851-1855.
Daniel B. Wesson ..... Founder and Inventor.
VOLCANIC REPEATING ARMS COMPANY, 1855-1857.
NEW HAVEN ARMS COMPANY, 1857-1865.
HENRY REPEATING ARMS COMPANY, 1865-1866.
WINCHESTER REPEATING ARMS COMPANY, 1866-
New Haven and Bridgeport, Conn.
Smith & Wesson, Volcanic and Henry Repeating Rifles, improved forms of Jennings, and forerunners of the modern Winchester Lever-Action Repeater.
B. Tyler Henry ..... Inventor and Founder.
Gov. Oliver Winchester ..... Financier and President.

COLT'S PATENT FIRE ARMS MFG. CO., Hartford, Conn.
Charles E. Billings ..... Toolmaker and Diesinker, 1856-62.
Christopher Spencer ..... Machinist, 1854-1857.
George A. Fairfield ..... Contractor, 1857-1865.
E. REMINGTON & SON, Ilion, New York.
Charles E. Billings ..... Forging Contractor, 1862-1865.
WEED SEWING MACHINE COMPANY, Hartford, Conn.
George A. Fairfield ..... Manager and President.
Charles E. Billings ..... Superintendent, 1865-1868.

ALBERT BALL, born at Boylston, Mass., in 1815, learned trade under WOOD & LIGHT, and WILLIAMS & RICH, of Worcester, Mass., Contractor with J. W. BOND, 1841-42.

THE BILLINGS & SPENCER COMPANY, Hartford, Conn.

ALBERT BALL, born at Boylston, Mass., in 1835, learned trade under WOOD & LIGHT, and WILLIAMS & RICH, of Worcester, Mass. Contractor with L. W. POND, 1861-63.

WILLIAM PALMER, brother of Courtlandt C. Palmer, was a successful Firearms Inventor of New York City.

ROGER W. LOVE, born at Providence, R. I., in 1842, was graduate of Brown University, and Artillery Officer.

DENIS LANE was a Plainfield, Vt., mechanic.

QUIMBY S. BACKUS learned trade under BAXTER D. WHITNEY of Winchendon, Massachusetts.

DAVID A. MOORE was a ROBBINS & LAWRENCE apprentice.

FREDERICK E. WELLS, born at Buckland, Mass., in 1844, was apprentice under E. G. LAMSON at Shelburne Falls.

GEORGE H. COATES was born at Windsor, Vt., in 1849.

EBEN STOCKER was born at Hartland, Vt., in 1846.

LUTHER HAWLEY was born at Windsor, Vt.

HENRY D. LAWRENCE, cousin of Richard S. Lawrence, was born at Windsor, Vt., in 1851. Graduated at Dartmouth.

RUSSELL L. JONES, born at Deerfield, Mass., in 1824, was owner of cotton mills at Colrain, Mass.

CHARLES JEWETT JONES was son and partner of above.

W. D. WOOLSON was clerk in First National Bank of Springfield, Vt. Came to J. & L. Co. at Windsor in 1888.

MACK D. MOWER was a Windsor, Vermont, schoolboy.

JAMES HARTNESS, born at Schenectady, N. Y., in 1861, learned trade at YOUNGLOVE, MASSEY & CO. and UNION STEEL SCREW WORKS at Cleveland. Later worked for UNION HARDWARE CO. of Torrington, and PRATT & WHITNEY West to Springfield as Superintendent of J. & L., 1889.

GILBERT A. DAVIS was a Windsor lawyer born in Chester.

MAXWELL EVARTS, born in New York in 1862, youngest son of Secretary of State Wm. M. Evarts, a native of Windsor. General Counsel of Southern Pacific R.R. and an associate of E. H. Harriman.

GEORGE O. GRIDLEY, born at Harwinton, Conn., in 1869, learned trade at WATERBURY BUTTON COMPANY, and came from Waterbury to Vermont with James Hartness.

FRANK L. CONE, born on a farm in Weathersfield, Vt., in 1868, learned trades of carpenter and patternmaker.

CHARLES A. MOORE, born at West Sparta, N. Y., in 1865, was Founder and President of MANNING, MAXWELL & MOORE.

R. P. SCHWERIN was an official of the Pacific Mail & Steamship Co. and an associate of Mr. Maxwell Evarts.

POTTER & JOHNSTON MACHINE CO., 1898.
Pawtucket, R. I.
James C. Potter ..... President and Engineer.
John Johnston ..... Vice President.

NEAL W. FOSTER, born at Chester, Vt., in 1884, learned machinist trade at WINDSOR MACHINE COMPANY. Later became Secretary to Mr. George O. Gridley.

DANIEL H. PARKER, born at Gardner, Mass. in 1882, was draftsman for BAXTER D. WHITNEY & SON, Winchendon.

STANDARD MFG. CO., HAKEWESSELL & HENN, 1888-1898. Hartford, Conn.
Spencer Coil Feed Automatic Screw Machines.
Christopher M. Spencer ..... Inventor.
Edwin C. Henn ..... Machinist and Contractor.
Reinhold Hakewessell ..... Draftsman and Toolmaker.

THE ACME MACHINE SCREW COMPANY, 1898-1902. Hartford, Conn.
Acme Automatic Screw Machines—Special Products.
A. W. Henn ..... Organizer and Secretary.
Edwin C. Henn ..... Superintendent and Inventor.
Reinhold Hakewessell ..... Inventor and Vice-President.

THE NATIONAL MANUFACTURING COMPANY, 1898-1902. (Offshoot from National Screw & Tack Co.) Cleveland.
Standard Products from Acme Automatics.
W. D. B. Alexander ..... Organizer and President.
Orrin S. Wernz ..... Secretary.

THE NATIONAL ACME MANUFACTURING COMPANY, 1902-1916. Cleveland—Montreal.
Acme Automatics—Auxiliaries and Products.
W. D. B. Alexander ..... President.
Orrin S. Wernz ..... Treasurer (Died in 1908).
A. W. Henn ..... Secretary.
Edwin C. Henn ..... Superintendent and Engineer.
(Note: Mr. Hakewessell retired in 1902 and with C. M. Spencer developed the Universal Automatic.)

THE NATIONAL ACME COMPANY, 1916. Cleveland—Montreal—Windsor, Vt.
Automatic Screw Machines—Auxiliary Machines—Opening Dies—Collapsing Taps—Screw Products.
A. W. Henn ..... President.
Edwin C. Henn ..... Vice-President and Engineer.
Oliver L. Henn ..... Demonstrator and Salesman.

LAMSON, GOODNOW & YALE, 1858-1864.
E. G. LAMSON & COMPANY, 1864-1865.
THE WINDSOR MANUFACTURING COMPANY, 1865-1870.
Single and Double Thread Sewing Machines—Machine Tools—Gun Machinery—Trip and Drop Hammers—Springfield Rifles—Ball's Repeating Carbines—Palmer's Breech Loading Carbines—Berdan's Rifles—Lane's Saw Mills—Stone Channeling and Quarrying Machinery—Special Machinery built to order.
Ebenezer G. Lamson ..... President and Manager.
Eastburne E. Lamson ..... Treasurer.
Ralph H. Lamson ..... Works Manager.
General Hiram Berdan ..... Firearms Expert.
Henry D. Stone ..... Designer and Machine Builder.
Albert Ball ..... Superintendent, 1863-1868.
William Palmer ..... Inventor of Palmer Carbine.
Roger Love ..... Bookkeeper.
Dennis Lane ..... Inventor of Saw Mills.
Quimby S. Backus ..... Machinist and Inventor.
David A. Moore ..... Inventor of Ratchet Wrench.
Frederick E. Wells ..... Bookkeeper and Cashier, 1860-1865.
George H. Coates ..... Apprentice and Machinist.
Eben Stocker ..... Apprentice.
Luther W. Hawley ..... Secretary.
Henry D. Lawrence ..... Apprentice and Bookkeeper.
Carlos Coolidge ..... Patent Attorney.

JONES, LAMSON & COMPANY, 1870-1883.
Cotton Cloth—Textile Machinery—Machine Tools.
JONES & LAMSON MACHINE CO., Windsor, Vt., 1876-1888.
Turret Lathes and other Machine Tools.
Ebenezer G. Lamson ..... Founder and President.
Eastburne E. Lamson ..... Secretary.
Ralph H. Lamson ..... Manager of Machine Business.
Russell L. Jones ..... Manager of Cotton Business.
Charles Jewett Jones ..... Treasurer.
Henry D. Stone ..... Inventor and Superintendent.
W. D. Woolson ..... Assistant Treasurer.
Mack D. Mower ..... Apprentice and Machinist.

THE WINDSOR MACHINE COMPANY, 1888-1915.
Turret Lathes—Gridley Automatic Lathes—Gridley Piston and Piston Ring Machines—Gridley Automatic Multiple Spindle Drills.
Gilbert A. Davis ..... President, 1888-1902.
George W. Hubbard ..... Managing Director, 1888-90.
Maxwell Evarts ..... President, 1902-06.
George O. Gridley ..... Inventor, Manager and Vice-Pres.
Frank L. Cone ..... Designer and Superintendent.
Mack D. Mower ..... General Foreman.
Charles A. Moore ..... Director and President, 1906-11.
R. P. Schwerin ..... Director, 1911-15.
James C. Potter ..... Director and President, 1911-15.
John Johnston ..... Director and Vice-Pres., 1911-15.
Neal W. Foster ..... Machinist, Later Secretary.
Daniel H. Parker ..... Designer and Production Man.
Henry E. Warren ..... Toolmaker.

THE NATIONAL ACME NEW ENGLAND PLANT, 1915.
Gridley Automatics.
George O. Gridley ..... General Manager, 1915-21.
Oliver L. Henn ..... Works Manager.
Neal W. Foster ..... General Manager and Asst. Treas.
Mack D. Mower ..... General Foreman.
Daniel H. Parker ..... Office Manager.

THE BILLINGS & SPENCER COMPANY, Hartford, Conn.
Charles E. Billings ..... Founder and President.
Christopher Spencer ..... Founder and Director.
Eben Stocker ..... Secretary.

HARTFORD MACHINE SCREW COMPANY, Hartford, Conn.
Christopher Spencer ..... Inventor of Hartford Automatic.
George A. Fairfield ..... Founder and President.

AMOSKEAG MANUFACTURING COMPANY, Manchester, N. H.
William B. Bement ..... Contractor, 1843-1845.
George W. Hubbard ..... Draftsman, 1855-1856.

INDUSTRIAL WORKS OF BEMENT & DOUGHERTY, Philadelphia
(Now Niles-Bement-Pond, owners of Pratt & Whitney Co.)
William B. Bement ..... Founder and Engineer.
George W. Hubbard ..... Assistant to Mr. Bement.
George V. Cresson ..... Apprentice Draftsman, 1855-60.

CRESSON, HUBBARD & SMITH (Now CRESSON-MORRIS CO.), Philadelphia.
George W. Hubbard ..... Founder and Engineer.
George V. Cresson ..... Founder and Manager.

GROUT & WHITE, Winchendon and Orange, Mass.
(Bought out Windsor Sewing Machine Business in 1861.)
Thomas White ..... Inventor and Machinist.
(Founder of WHITE SEWING MACHINE CO.)

CLEVELAND AUTOMACTIC MACHINE CO. and WHITE CO. at Cleveland, Ohio.)
W. L. Grout ..... Inventor and Machinist.
(A founder of NEW HOME SEWING MACHINE CO.)

Invented CENTERFIRE CARTRIDGE and BERDAN RUSSIAN RIFLE.

SULLIVAN MACHINERY COMPANY, Claremont, N. H.
Albert Ball ..... Founder and Engineer, 1868-1915.
Roger Love ..... Founder and Treasurer.
(Proprietor of The DANVERSPORT ROLLING MILL, 1876-78.)

LANE MANUFACTURING COMPANY, Montpelier, Vt.
Dennis Lane ..... Inventor and Founder, 1872-

BACKUS VISE CO., Windsor, Vt., and Millers Falls, Mass.
(Now part of MILLERS FALLS COMPANY.)
Quimby S. Backus ..... Inventor of Vise, Founder.
Ralph H. Lamson ..... Manager at Windsor.

WILEY & RUSSELL MFG. COMPANY, Greenfield, Mass.
WELLS BROTHERS COMPANY, Greenfield, Mass.
F. E. WELLS & SONS COMPANY, Greenfield, Mass.
(Now the GREENFIELD TAP & DIE CORPORATION.)
Frederick E. Wells ..... Organizer and President.

COATES CLIPPER MANUFACTURING CO., Worcester, Mass.
George H. Coates ..... Founder and President, 1877-1921.
Frank L. Cone ..... President, 1921-

ESTEY ORGAN COMPANY, Brattleboro, Vermont.
Luther Hawley ..... Secretary, 1870-

Industrial Pioneer of Sherbrooke, Province of Quebec.
A founder of the CANADIAN INGERSOLL-RAND CO.

JONES & LAMSON MACHINE CO., Springfield, Vt., 1888-
Hartness Flat Turret Lathes.
James Hartness ..... Inventor and President, 1889-
(Pres. of A.S.M.E. 1914; Governor of Vermont, 1921.)
W. D. Woolson ..... Treasurer, 1888-
E. R. Fellows ..... Designer.
George O. Gridley ..... Secretary to Mr. Hartness.
W. L. Bryant ..... Draftsman.
F. P. Lovejoy ..... Draftsman.
Charles N. Safford ..... Accountant.
Related Concerns:
FITCHBURG MACHINE WORKS, Fitchburg, Mass.
James Hartness ..... Inventor of "LO-SWING" Lathe.
THE FELLOWS GEAR SHAPER CO., Springfield, Vt.
E. R. Fellows ..... President and General Manager.
W. D. Woolson ..... Treasurer.
BRYANT CHUCKING GRINDER CO., Springfield, Vt.
W. L. Bryant ..... Inventor and President.
LOVEJOY TOOL COMPANY, Springfield, Vt.
F. P. Lovejoy ..... President.
Charles N. Safford ..... Treasurer.

Gridley Automatic Drill is now the "SUPER-MATIC," built by the ACME MACHINE TOOL COMPANY, Cincinnati.

MAC-IT PARTS COMPANY, Windsor, Vt. 1910-1912.
(Removed to Lancaster, Pa., in 1912.)
Frank L. Cone ..... A Founder and Director, 1910-12.
Henry E. Warren ..... Inventor and General Manager.

CONE AUTOMATIC MACHINE COMPANY, Windsor, Vt., 1916-
Frank L. Cone ..... Founder and President.

FIG. 2—GENEALOGICAL CHART

FIG. 1—THE VILLAGE OF WINDSOR, FROM AN OLD LITHOGRAPH

mouth of Mill Stream, and before 1769 a sawmill at the upper one and a gristmill at the lower one were in operation, Israel Curtis and his son Zebina being the pioneer manufacturers of Windsor. It was about these dams that much of mechanical history was to be made within the next hundred and forty-two years.

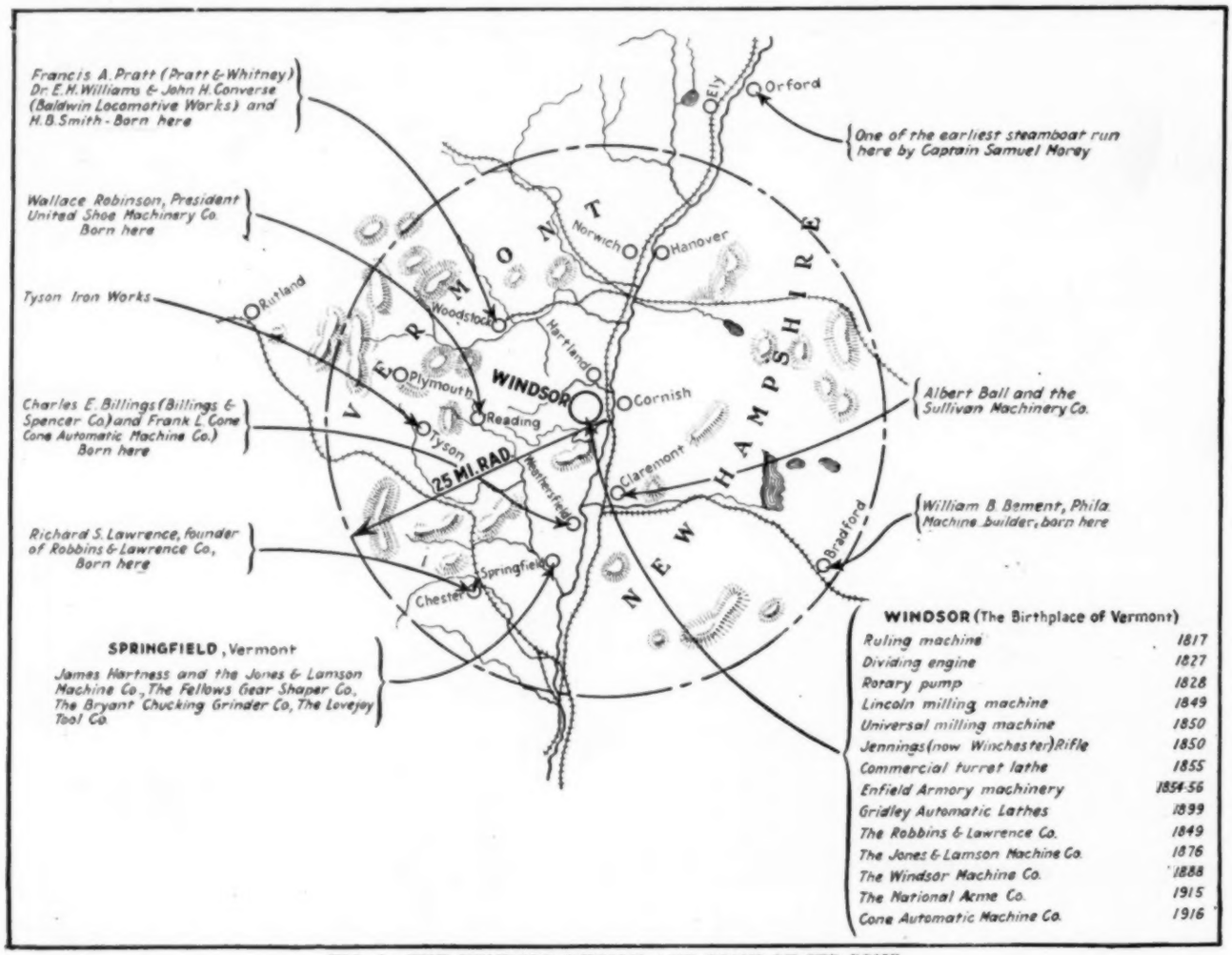

Francis A. Pratt (Pratt & Whitney) Dr. E. H. Williams & John H. Converse (Baldwin Locomotive Works) and H. B. Smith - Born here
Wallace Robinson, President United Shoe Machinery Co. Born here
Tyson Iron Works
Charles E. Billings (Billings & Spencer Co.) and Frank L. Cone Cone Automatic Machine Co.) Born here
Richard S. Lawrence, founder of Robbins & Lawrence Co., Born here
SPRINGFIELD, Vermont
James Hartness and the Jones & Lamson Machine Co., The Fellows Gear Shaper Co., The Bryant Chucking Grinder Co., The Lovejoy Tool Co.
One of the earliest steamboat runs here by Captain Samuel Morey
Albert Ball and the Sullivan Machinery Co.
William B. Bement, Phila. Machine builder, born here
WINDSOR (The Birthplace of Vermont)
Ruling machine 1817
Dividing engine 1827
Rotary pump 1828
Lincoln milling machine 1849
Universal milling machine 1850
Jennings (now Winchester) Rifle 1850
Commercial turret lathe 1855
Enfield Armory machinery 1854-56
Gridley Automatic Lathes 1899
The Robbins & Lawrence Co. 1849
The Jones & Lamson Machine Co. 1876
The Windsor Machine Co. 1888
The National Acme Co. 1915
Cone Automatic Machine Co. 1916
WINDSOR
Plymouth
Reading
Cornish
Hartland
Woodstock
Rutland
Tyson
Springfield
Chester
Weathersfield
Claremont
Bradford
Norwich
Hanover
Orford
Ely
25 MI. RAD.
VERMONT
NEW HAMPSHIRE

FIG. 3—THE WINDSOR REGION AND SOME OF ITS SONS

Tooth Forms of Green, Burnished, Hardened and Ground Gears

By K. L. HERRMANN
Studebaker Corporation

Conclusion of the article — Changes due to repeated hardening—Grinding teeth of spiral bevel-gears more important than teeth of spur gears—Hobbing machines

CURVES combining the findings of many tests made are shown in Fig. 11. The curve at the top represents one side of a green-gear tooth with the spacing error shown at the right-hand side. The second full line represents this same tooth-form, while the dotted line shows the tooth-form after carburizing. The next pair of curves show the tooth-form after the first hardening. For the purpose of further studying variations, the gears from which these curves were made was hardened ten times with variations as shown in the succeeding curves both for tooth-form and spacing. One of the many interesting features is that this gear continued to shrink in outside diameter, which after the final hardening, was 0.040 in. under the original diameter, while the root diameter steadily increased. Another subject for very careful study can be found in the curves produced by checking for spacing.

The change in the shape of this gear is shown

A paper presented at the Annual Convention of the American Gear Manufacturer's Association, Cleveland, Ohio, April 21, 1923.

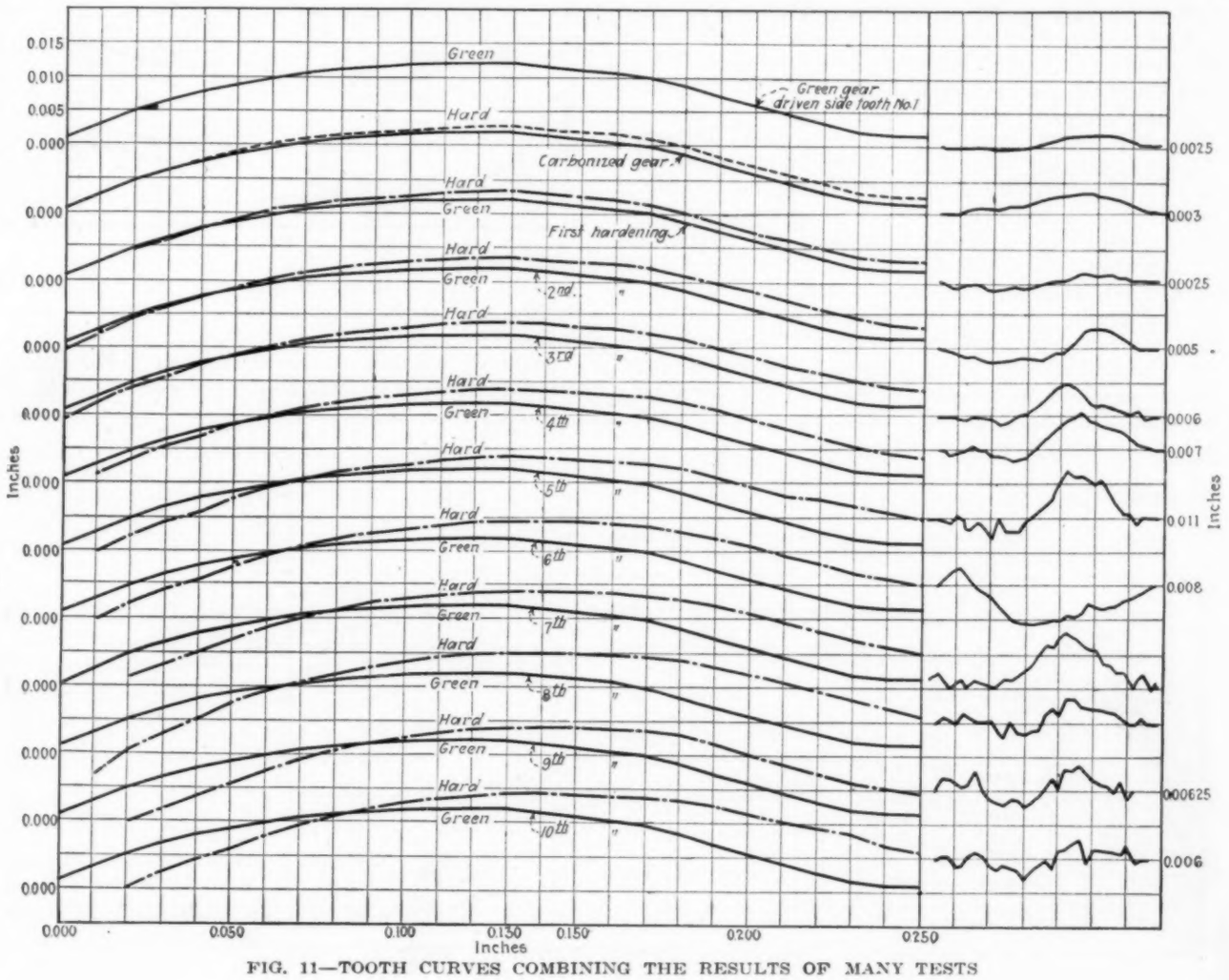


FIG. 11—TOOTH CURVES COMBINING THE RESULTS OF MANY TESTS

graphically and somewhat exaggerated in Fig. 12. It will be noted that the tooth thickness was reduced at the point, while at the base considerable expansion took place. The possibilities when more favorable steel and hardening conditions are selected, are shown in Fig. 13. One of many experiments consisted of careful forging,

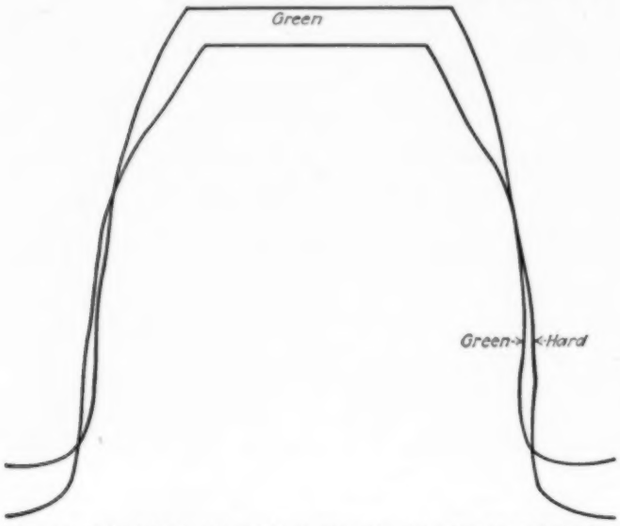


FIG. 12—CHANGES OF TOOTH SHAPE DUE TO HARDENING

heat treating, cutting and hardening these gears, all under the observation of an experienced metallurgist.

The results relative to spacing when checked by the previously described method are shown in Fig. 14 in which the full line is the green gear, and the dot-dash line the hardened gear. It will be seen that although these gears were forged, cut and heat-treated alike, No. 4 gear came out radically different from the others. Similar tests were made by cutting gears, the blanks for which were taken from several positions in a billet. The results were inconsistent because two gears, side by side, taken from the same plane of the billet did not in any way produce comparable results.

The curves of spiral bevel-gears in Fig. 15 were plotted from tests made by the fixtures shown in Fig. 22. In spiral-bevel gears, hardening changes in tooth form may lead to the impression that the teeth have straightened out. A careful examination of these curves will indicate that this is not necessarily true, and that if grinding spur gears has a decided advantage, grinding spiral bevel-gears is of still greater importance. This is especially so, because of the many limitations in the selection of steels that will stand up in gears in rear axle work.

The coast and drive sides of gears ground on the Lees-Bradner machine are shown in Fig. 16. The accuracy of these tooth forms and the consistency with which this accuracy is produced is found even more

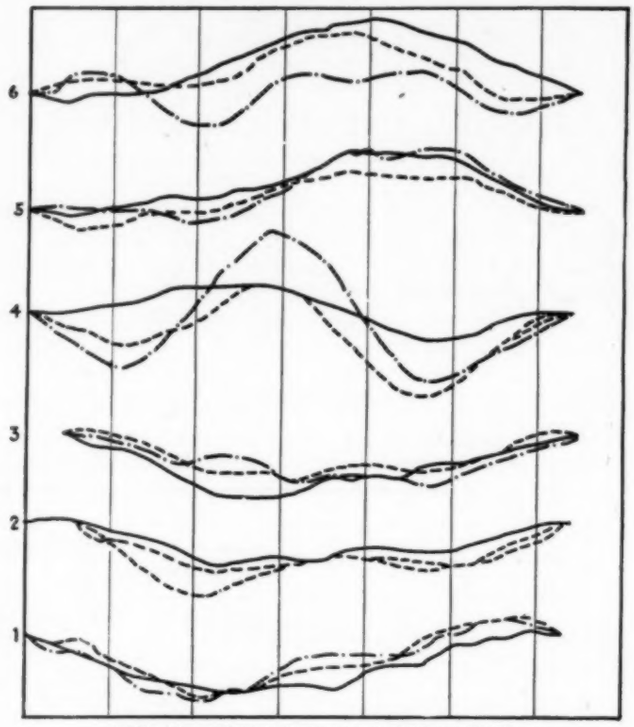


FIG. 14—RESULTS OF SPACING TESTS

favorable than is indicated by the several curves. The machine on which these gears were ground is shown in Fig. 17.

Gears of equal accuracy ground on the American Grinding Machine Co.'s machine are shown in Fig. 18.

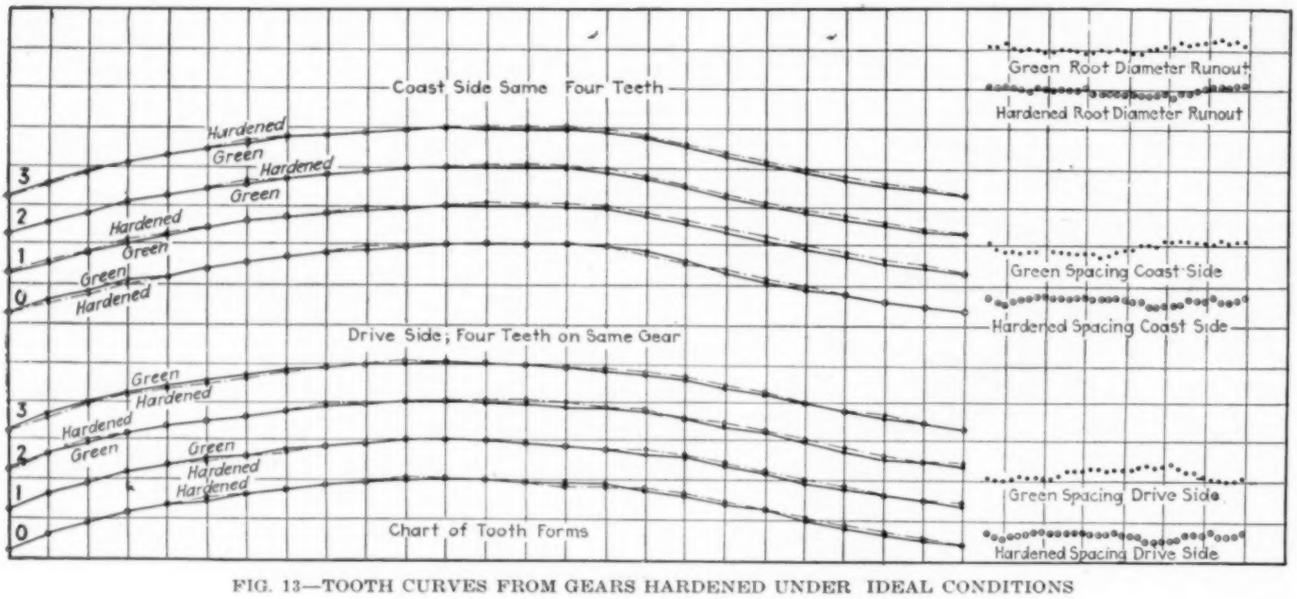


FIG. 13—TOOTH CURVES FROM GEARS HARDENED UNDER IDEAL CONDITIONS

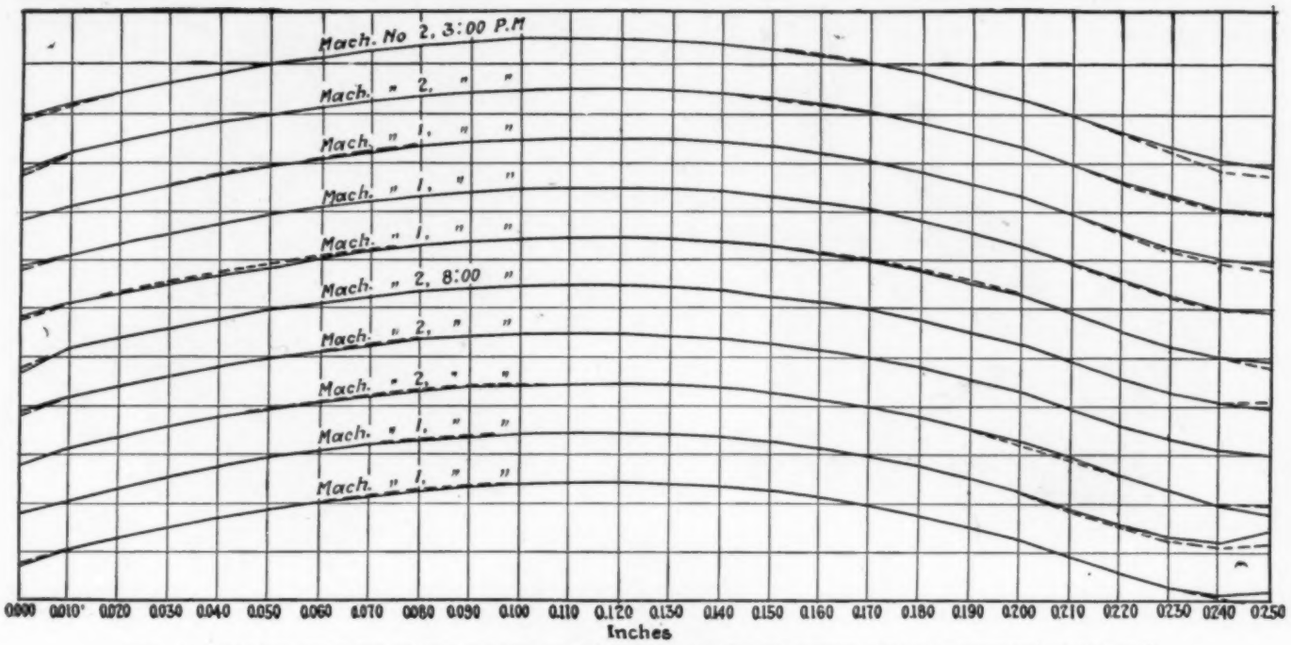


FIG. 16—TOOTH CURVES FROM GEARS GROUND ON LEES-BRADNER GEAR GRINDING MACHINE

The results of checking for spacing are of interest. The machine on which these gears were ground is shown in Fig. 19.

In Fig. 20 is shown one of the universal checking fixtures used in our plants. We have several types along similar lines which we prefer to use, because for a number of years, curves have been made on these fixtures and studied by us. There is, however, offered a series of new fixtures for checking tooth-forms, a very good one being manufactured by the Illinois Tool

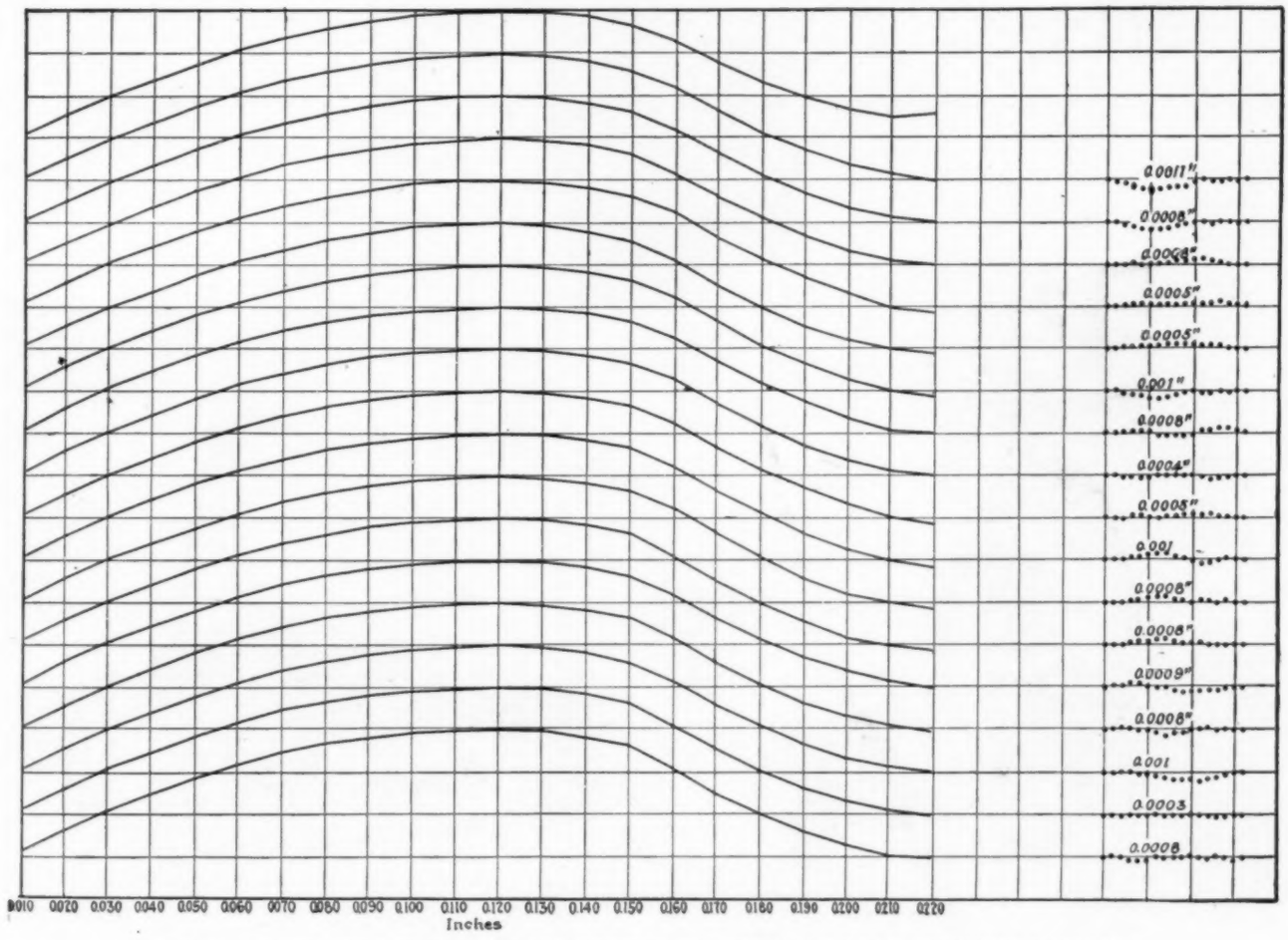
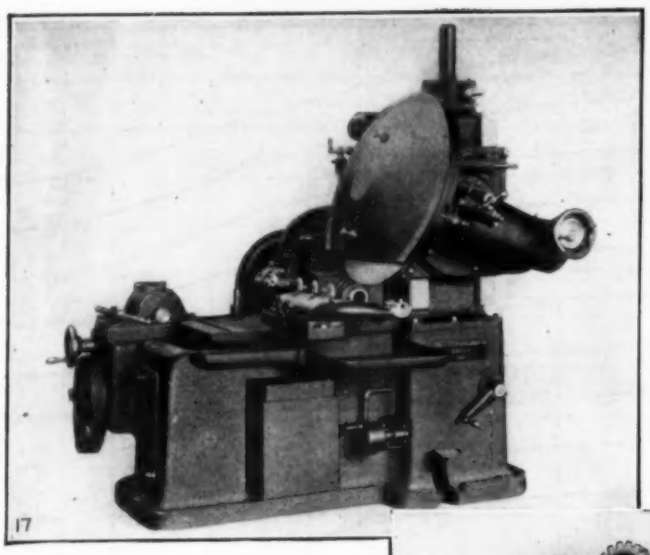
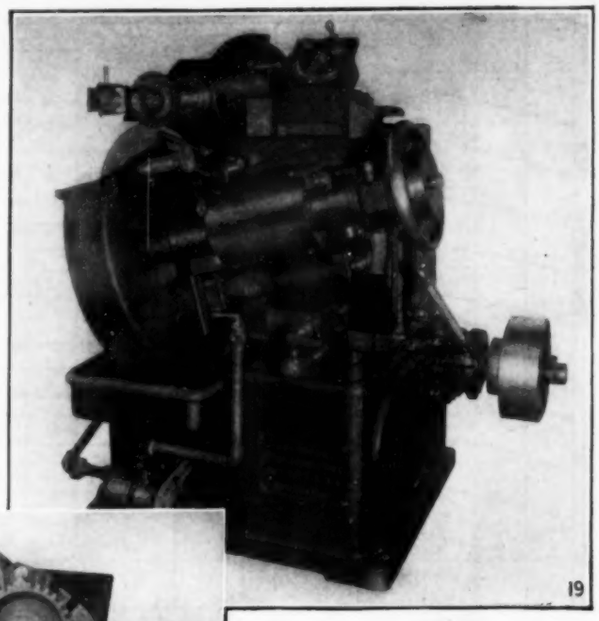
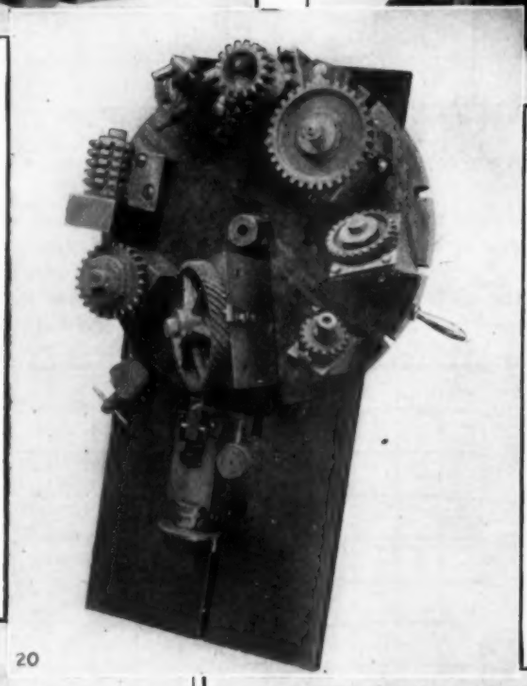
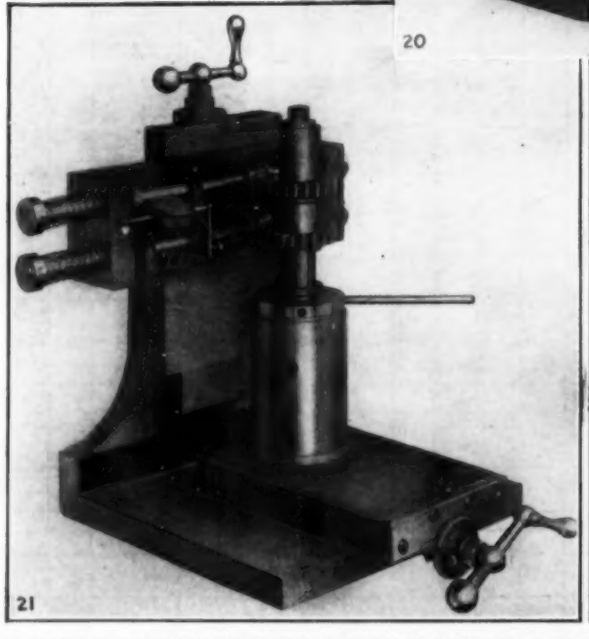


FIG. 18—TOOTH CURVES FROM GEARS GROUND ON AMERICAN GEAR GRINDING MACHINE









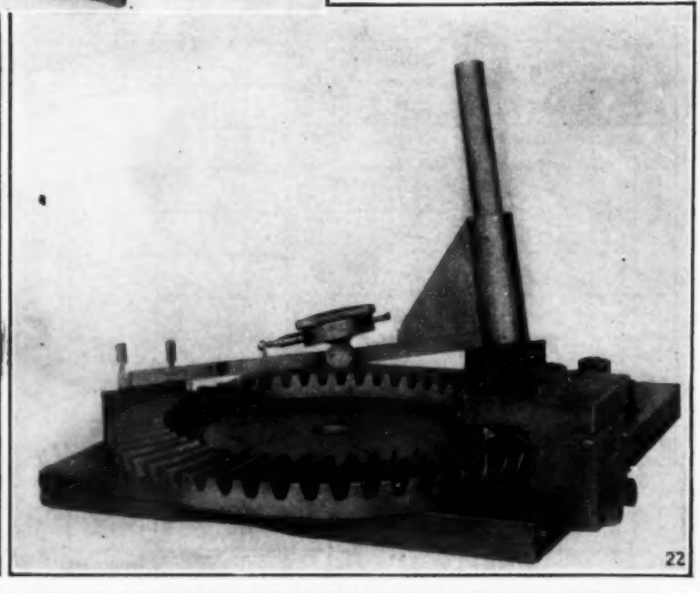


FIG. 17—LEES-BRADNER GEAR GRINDING MACHINE. FIG. 19—AMERICAN GEAR GRINDING MACHINE. FIG. 20—UNIVERSAL FIXTURE FOR CHECKING GEARS. FIG. 21—ANOTHER TYPE OF GEAR-CHECKING FIXTURE. FIG. 22—FIXTURE FOR CHECKING SPIRAL BEVEL GEARS

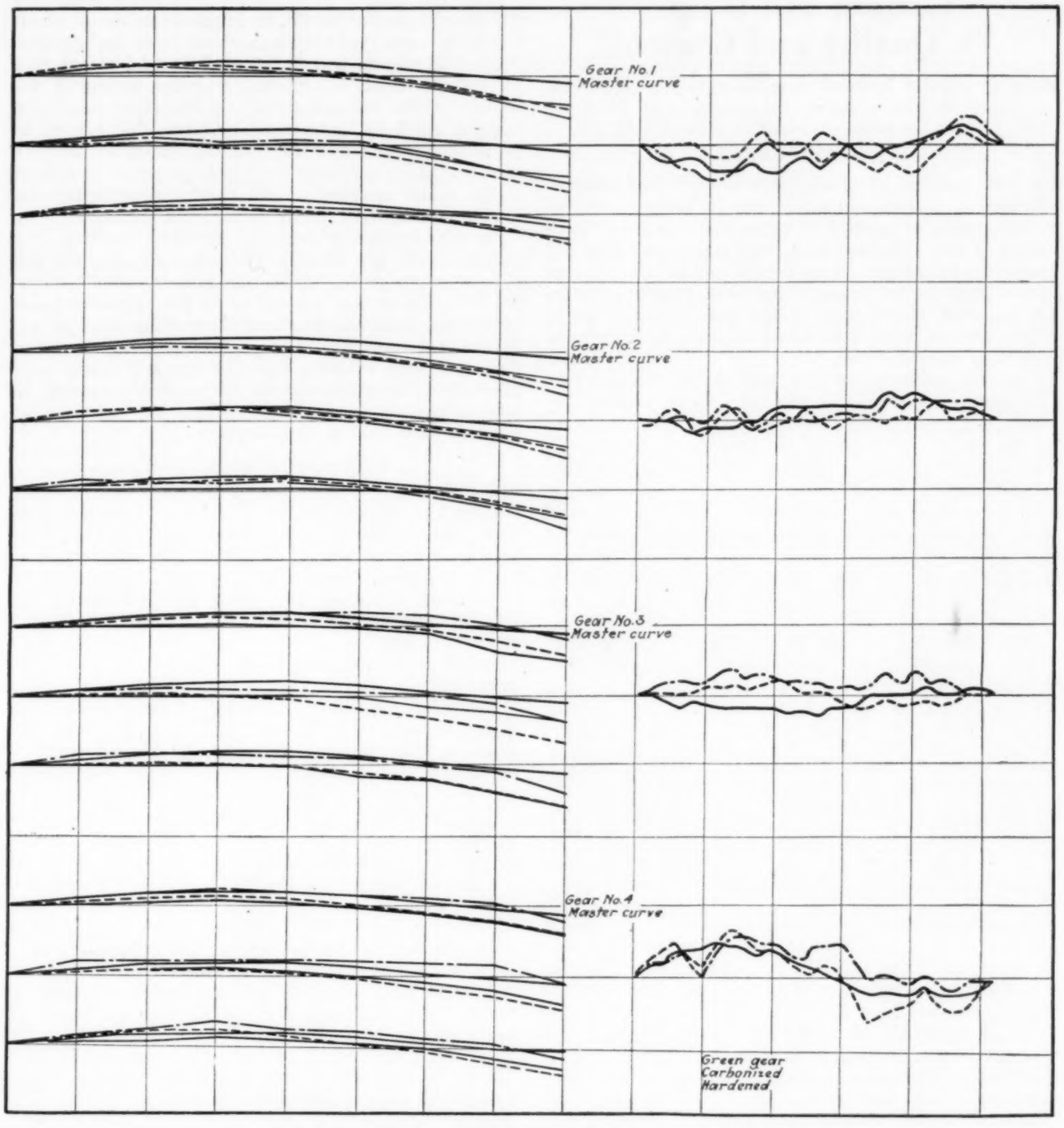


FIG. 15—CURVES FROM TEETH OF SPIRAL BEVEL-GEARS

Co. The same company also supplies checking equipment for various cutters and cutting machines. We understand that more recently the Lees-Bradner Co. has put out a very efficient gear-tooth checking fixture.

The Gear Grinding Machine Co. is supplying the fixture shown in Fig. 21. This is the most rapid and accurate production checking fixture with which we have had experience. It is also made with attachments for charting. These three fixtures deserve the serious attention of those studying gear tooth-forms.

Time and space limitations prevent the discussion of the many details which the charting of gear tooth-forms and spacing has brought out, also the acknowledgment in detail of the help rendered by representatives of such firms as Barber-Coleman, Brown & Sharpe, Gould & Eberhardt, Lees-Bradner, Pratt & Whitney, and especially Mr. England of the Illinois Tool Works and Mr. Hazelton of the Cincinnati Gear Cutting Machine Co., both of whom have in an unusual way assisted in the progress of this work.

[The experiments described and the results and data given in this article show conclusively that the problems in gearing confronting the automobile manufacturer are many and varied. It is evident that automotive engineers are going ot the elimination of gear noises in the right way and it is to be hoped their efforts will result in practically noiseless gearing in the near future.—Editor.]

Custom and Usage Vs. Quality and Content

Right of seller of industrial supplies to prove custom and usage, relative to quality and content, in the face of the terms of a written contract

By Leslie Childs

THE question of when, and under what circumstances, custom and usage may be proven, relative to the quality or content of materials or supplies purchased is one of considerable importance to industrial executives in general. This is true because in contracts of this kind not infrequently words used carry a different meaning, in the light of the custom and usage of a given trade, than is ascribed to them in their ordinary and every-day use.

To meet this situation then, the law has declared that the meaning of words, in the light of the custom and usage of a given trade, is admissible to prove the intent of the parties, and this in the face of the terms of a written contract that according to the ordinary meaning of the words used may import a different construction. The importance of a knowledge of the limitations of this rule to the industrial executive charged with the entering into contracts of this kind is fairly obvious, and its practical application to a particular situation may prove of interest and perhaps some profit to even the best informed.

With this in mind, the recent Pennsylvania case of the Electric Reduction Co. vs. the Colonial Steel Co., 120 Atl. 116, is well worth a brief examination. The facts and circumstances which culminated in the action were, as taken from the report, in the main as follows:

Contract to Furnish Ferro-Tungsten Powder "Free From Tin" Entered Into

The Electric Reduction Co. sold and delivered to the Colonial Steel Co. a large quantity of ferro-tungsten powder. The contract of sale, which was in writing, stipulated that the material so supplied should be "free from copper, tin and all other impurities."

Delivery under the contract was made in five separate consignments. The first shipment was accepted and paid for, and a substantial sum had been paid upon the last four deliveries when, it appears, the Colonial Steel Co. caused analyses to be made which showed the last shipments contained tin. Upon making this discovery the steel company notified the other of the rejection of the shipments named, and asked for directions as to their disposition.

A controversy followed which resulted in the filing of the instant suit by the Electric Reduction Co. in an attempt to recover the balance of the purchase price, in accordance with the terms of the contract. The outcome of this lawsuit turned on the interpretation to be given the words, "free from copper, tin and all other impurities" as used in the contract of sale.

The Electric Reduction Co. admitted that the article supplied did contain a certain amount of tin, but contended that the words "free from tin" as used in the contract complied with a general and universal meaning with respect to the sale of ferro-tungsten powder and meant that the article was commercially free from tin; and that the parties so used these words in the contract. The Colonial Steel Co. denied the correctness of this contention and the outcome of the case turned on this one question.

Upon the trial of the case the trial court permitted the Electric Reduction Co. to introduce evidence which tended to prove that the words "free from tin," according to the custom and usage of the trade, meant that tin did not exist in sufficient quantity to impair the quality of the finished steel. On the other hand, the Colonial Steel Co. introduced evidence that tended to prove that the words "free from tin" meant what they said, and that there was no custom or usage in respect to the trade meaning of the words as contended for by the other.

On this conflicting evidence, the trial resulted in a judgment for the Electric Reduction Co. for the full amount of its claim. From this judgment the Colonial Steel Co. prosecuted an appeal to the Supreme Court of Pennsylvania where, among other things, it was contended that error was committed in allowing the introduction of this evidence as to custom and usage, as it tended to vary the terms of the written contract. In passing upon this phase of the case the court quoted in part, from 17 C. J. 498, as follows:

Ruling of Supreme Court

"While words in a contract relating to the ordinary transactions of life are to be construed according to their plain, ordinary and popular meaning, yet, if, in reference to the subject-matter of the contract, particular words and expressions have by usage acquired a meaning different from their plain, ordinary and popular meaning, the parties using those words in such a contract must be taken to have used them in their peculiar sense and that sense may be fixed by parol evidence."

Following the above statement of the generally accepted reason, for allowing the introduction of parol evidence in respect to custom and usage, the court in approving the application of the rule in the instant case, among other things, said:

"The admission of evidence of a custom is not dependent on the rule that parol evidence is inadmissible to vary a writing, nor inconsistent therewith, but upon the ground that the law makes the custom a part of the contract. . . . Our conclusion is that in the case before us parol evidence was properly admitted to show the trade meaning of the words in dispute. . . ."

In conclusion, after giving additional reasons for its conclusion and considering other points not material to the subject of this article, the Supreme Court of Pennsylvania affirmed the judgment rendered in the lower court in favor of the Electric Reduction Co., holding, as outlined in the opinion, that parol evidence relative to the trade meaning of the term "free from tin" was properly admitted, and the judgment resulting from the trial of the issue so raised would not be disturbed.

The foregoing Pennsylvania decision is one of force and value on the point decided. It illustrates in a clear manner the application of the rule which permits the introduction of parol evidence to prove custom and usage in the face of the specific terms of a written contract. And if, in a given contract, words are used that are susceptible of both a custom and usage and ordinary meaning, a mutual interpretation of their meaning might with profit be inserted in the contract for security against after dispute. Truly then, when taken in connection with the facts involved, this Pennsylvania decision becomes one well worth having in mind, by industrial executives in general, when contracts of the character described in the case reviewed are being entered into.

Repairing Locomotives in a Machine-Tool Shop

BY SPECIAL CORRESPONDENCE

The second of three articles—Rod, valve and motion work—Worn guides, crossheads and pistons built up with manganese bronze — Welding broken frames

ROD, VALVE AND motion work is carried on in separate departments manned by operatives skilled in their particular work, to which each operative devotes his entire time and is thus enabled to concentrate his attention upon the problems immediately before him. These departments are located in the central section of the shop under the sawtooth roof and adjoining the locomotive floor, so that the latter is readily accessible when a workman is obliged to get a measurement from, or fit a part to, any particular engine.

To the rod department, a general view of which may be seen in Fig. 8, the main and side rods are delivered when first taken from the engine, and here they are inspected for cracks, which by this time have made themselves visible by the exudation of oil upon the white painted surfaces referred to in the previous article. If serious defects are found a rod is scrapped and an order sent out for a forging to replace it.

Replacement of the bronze bushings of side rods and the replacement or re-boring of the two-piece crankpin brasses of the main rods is a practical certainty, and as soon as a rod is checked over to determine its fitness for further service it is dispatched to the forcing press at one end of this department to have the bushings pressed out.

Standard sizes are adhered to as closely as possible

FIG. 8—A VIEW IN THE ROD DEPARTMENT

so that if a rod is undamaged, new bushings are ready to be forced in and scraped to a bearing upon the pins. In some cases the holes in the rod may be pounded out of shape by reason of the engine having remained too long in service, and in such cases it is necessary to re-bore the holes and fit special bushings.

Main rod brasses are often fitted with babbitt strips, hammered into transverse dovetailed grooves in the brass. In Fig. 9 may be seen such a brass in the vise where it is undergoing the scraping operation to fit the composite surface to the crank-pin.

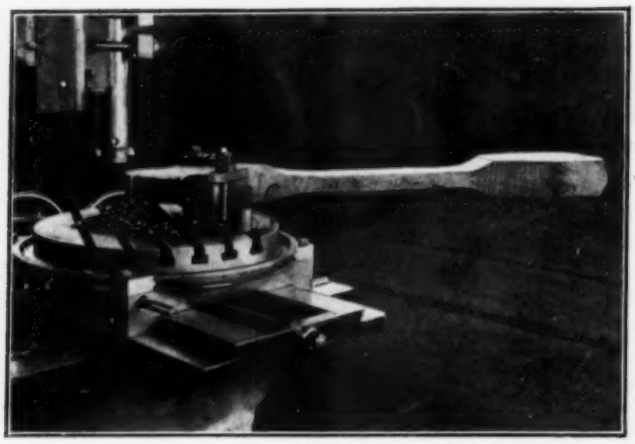
The forging for a new side rod of the articulated type is shown in Figs. 10 and 11, in the preliminary stages

FIG. 9—A MAIN ROD BRASS WITH BABBITT BEARING-STRIPS

of its machining. The sides of the forging are first planed off at the enlarged ends to provide a convenient surface for laying out, and the surface is then chalked and laid out in accordance with the original drawing of the locomotive to which it belongs. It is not, as a rule, difficult to obtain the original drawings of an engine from its builders, but if such drawings are unavailable the rod must be laid out from measurements taken from the engine.

After a rod is thus laid out it goes to the slotting machine, Fig. 10, where the contour is machined approximately to line, and from there it is taken to a vertical milling machine, Fig. 12, to be finished exactly to line. When the ends are milled, the rod then goes to the double-head shaper, Fig. 13, where the fillets are formed to join the plain middle section with the enlarged ends.

The middle section of the rod is finished by planing on four sides and is then channelled out on one side for the purpose of reducing the weight. Because of the fact that this part of the rod is tapered and that the sides of the channel are to be parallel with the outer surfaces



FG. 10—A SIDE-ROD IN THE SLOTTER

instead of with each other, it is necessary to take two cuts over the length of the rod when milling the channel. The work is done on an Ingersoll planer-type milling machine with a cutter equal in width to the narrow end of the channel, the rod being reset for the second cut.

In Fig. 14, a new rod is shown set up in a horizontal boring mill for the purpose of boring the holes for the crankpin brasses and also for the knuckle pin that joins the two sections of the side rod together. Accuracy of spacing in the matter of center distances is of extreme

FIG. 11—FORGING FOR A SIDE-ROD

importance, for this distance must, of course, conform exactly with the center distance between the driving wheels of the engine.

The importance of autogenous welding in railroad repairs can hardly be overestimated. Not only are many of the minor parts salvaged by its application, but rarely does one see in a locomotive repair-shop an engine that has not at some time required a welding operation

FIG. 12—MILLING THE END OF THE ROD

upon its main frames, a defect which before the days of autogenous welding, would have involved almost a complete rebuilding of the machine.

At the time these photographs were made there was in the shop a very heavy locomotive of the consolidation type which had a broken frame. A forging was made to

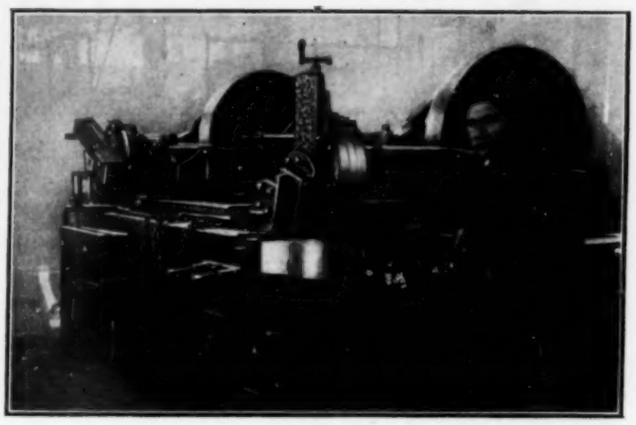


FIG. 13—PLANING THE FILLETS

replace the forward end of the frame, which was broken through the forward yoke. That end of the frame was taken out and the new piece welded in its place. As the work was carried on at the same time with other necessary repairs, there was no extra delay in restoring the engine to service.

FIG. 14—BORING HOLES IN THE ROD FOR THE BRASSES

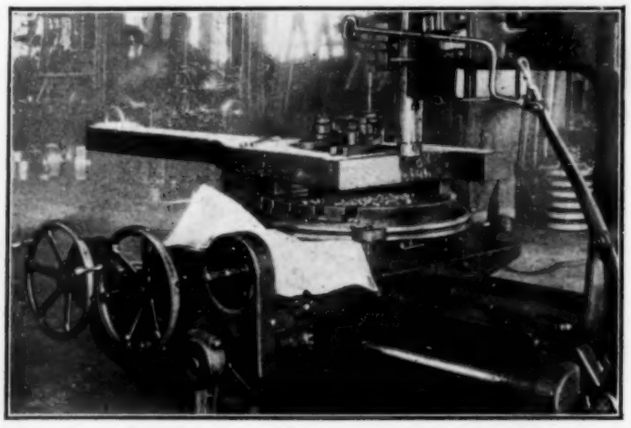


FIG. 15—MACHINING A NEW SECTION TO BE WELDED INTO THE MAIN FRAME

The weld was made by the electric arc process, the time required being something less than four hours. The work was done by the foreman-welder and one helper. Fig 15 shows the new part of the frame on a slotting

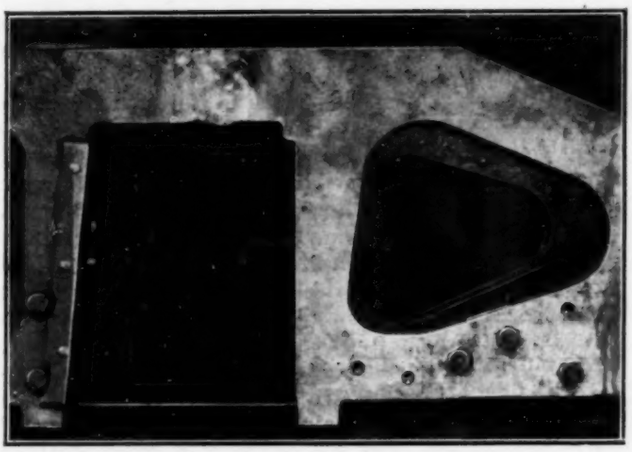


FIG. 16—COMPLETED WELD ON THE MAIN FRAME

machine where it is being machined to shape, and Fig. 16 shows the weld after completion.

Thermit welding also is applied to the mending and especially to the reinforcing of locomotive frames. Such a reinforcement at a point where other engines of the same kind had developed weakness is shown in Fig 17, applied to the frame of an engine of the Santa Fé type. Both frames were reinforced in the same manner, 800 lb. of metal being melted simultaneously in two crucibles. The picture shows the weld immediately after the molds had been removed and the sprues and risers cut off by means of the acetylene torch.

Worn crosshead guides, that before welding was available would have to be replaced, are now built up with the aid of the oxy-acetylene torch and replaned as in Fig. 18, being made ready to put back into service in a few hours instead of a week or more as formerly.

Crosshead shoes are renewed by welding plates of steel in the bearing surfaces and replaning the shoes to the original dimensions. Fig. 19 shows planing the guide bearings of the shoes with the crosshead in place on the rod, by which means accuracy of alignment is assured.

Locomotive pistons are peculiarly subject to wear,

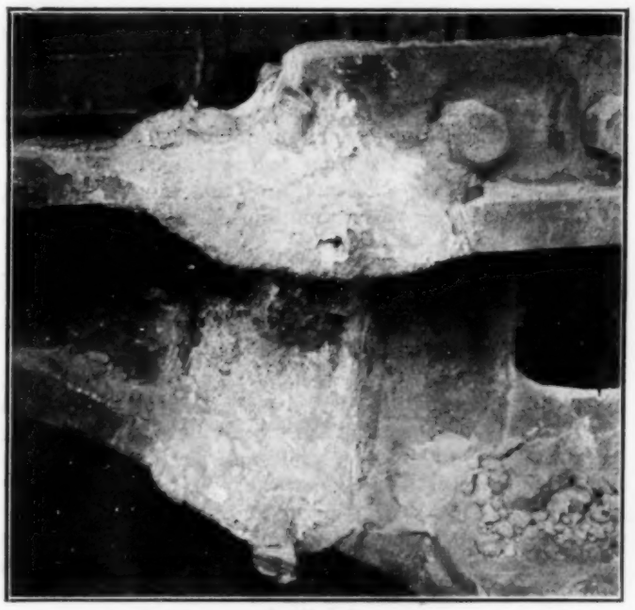


FIG. 17—MAIN FRAME REINFORCED BY THERMIT WELDING

and a worn piston is out of round for the reason that the wear is always on the lower half. Instead of scrapping the worn piston and substituting a new one, the welder builds up the worn part with manganese bronze and the piston is re-turned to its original diameter.

Welding is also applied to the mending of cracked

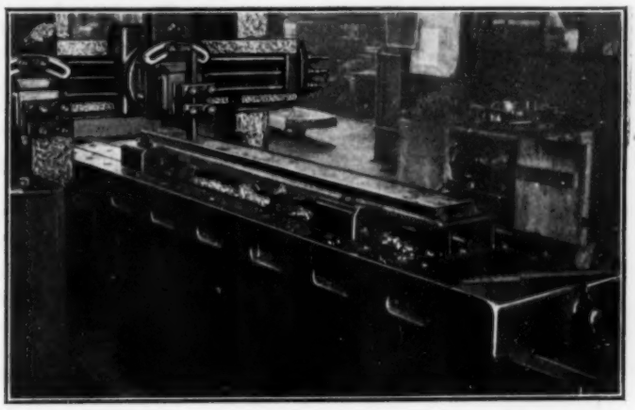


FIG. 18—REPLANING CROSSHEAD GUIDES

and broken cylinders, valve chambers, etc., and to many of the minor parts of an engine. No other process discovered in recent years has contributed so much to the advantage of railroad repairs, as by its use many parts

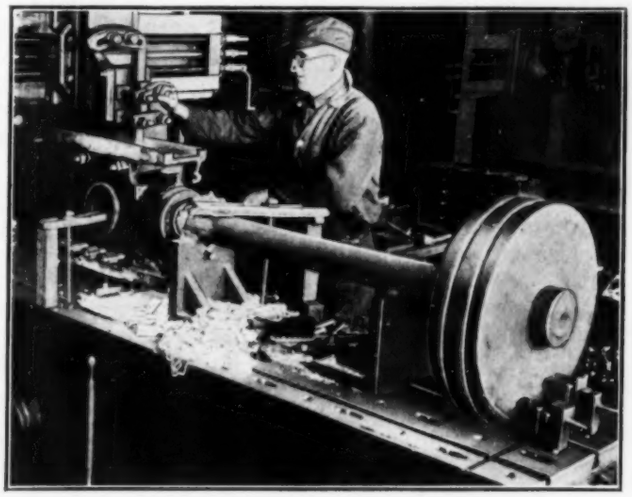


FIG. 19—RE-PLANING CROSSHEAD SHOES

that would have formerly taken days and even weeks to replace, can now be restored to service in a few hours at most, and with the strength of the part advanced beyond its original capacity by any degree that may be desired.

Canada Takes More Agricultural Implements

Preliminary statistics of Canadian trade for 1922-23, compiled by the Dominion Bureau of Statistics show that agricultural implements valued at $8,423,995 were imported into Canada during the fiscal year ended March 31, 1923. The Department of Commerce reports that this is a slight increase over the fiscal year 1921-22, when implements imported were valued at $7,718,032. Practically all of these imports were from the United States, amounting to $7,546,472 in 1921-22 and $8,352,-071 in 1922-23 the report states.

The Electrician

By George Walter
In Charge of Maintenance, Millholland Machine Co.

ECONOMIC conditions in manufacturing America during the past two years or more have caused a great many changes to be made in the organization of factory and machine-shop personnel. Reductions have been made wherever possible and individual production has been materially speeded up. Overhead expense has been cut down to the limit and wages have been reduced by manufacturers struggling for an existence over the lean period. With the hope of better meeting keen competition the employers have steadily demanded more and better work from the workmen.

They have found one of the hardest types of employee to deal with in this situation to be the man engaged in maintenance work. He knows that the shop superintendent must be tied up heart and soul in production. The average shop superintendent knows but little concerning the real nature of maintenance work; he knows that when something breaks down it must be repaired. The maintenance man then appears very important.

Electricity in industry is comparatively new. Men who have had their minds full of mechanical problems have found little time to devote to its study. They have found it cheaper and more satisfactory to turn the care of the electrical equipment in their shop over to a man who has made electricity his field. They do know that many queer things happen in the electrical world, and their minds are to a certain extent open to the tales of the electrician when he "gets up against it." The fact remains, however, that the electrician no longer stands upon the pinnacle he once did. There has been a tremendous slump in the demand and price offered for his services.

Low Wages Offered Electricians

Over a year ago I found myself temporarily out of employment, and decided to apply for an electrician's berth somewhere. I found that almost every place where I applied had approximately fifty per cent of the men laid off, and twice as many on the waiting list. A millwright, an oiler or a handy man had been pressed into service renewing fuses and lamps, oiling cranes and motors, and doing such jobs. As to wages: "Considering that you have had quite a little experience, I could probably find a place for you at — cents per hour." The rate was less than ten per cent above that being paid labor at the time. I was looking for a temporary job and had laid no claims to being anything of an expert. I had simply claimed to be a first-class electrician. Nevertheless it quite clearly demonstrated the employer's classification of the present-day electrician.

This employer may not know much about electrical maintenance work, but he does know when he gets results. If he has to send for outside help every time a starting box gets out of order he wants to know what the trouble is. If he is told that the plant electrician is as good as the ordinary, he is apt to decide that the ordinary is not so very good.

A man electrically inclined should after a year's experience as a helper, be qualified to become a plant electrician. This electrician is not expected to be a technically trained man. It is expected, however, that he be a man with a thorough working knowledge of the plant's electrical equipment.

He should have an intimate acquaintance with the starting boxes and the motors. He should know the type of construction of the electrical equipment on the overhead cranes, what the inside of the plant's transformers look like and what each one is for, and the different voltages used in the plant and why. It is a good plan for him to know every line of conduit, its capacity and present load, its voltage and the kind of current.

He should not only know the right and the wrong way to install a motor or a line of conduit, but he should be able to do the work itself and in its entirety. It is important that he know the right and wrong way to install a knife switch; it may save a life some day, maybe his own. He should at an early date make himself thoroughly familiar with the latest rulings of the underwriters. He may thus be able to save himself much humiliation, and his company a great deal of money

The Electrician's Self-Conceit

Because of the danger of having inexperienced help manipulate electrical equipment, the average employer feels duty bound to have an experienced man at hand for this purpose. This man is the so-called electrician. You can see him idling around the shop almost any time of the day. When a fuse blows out he saunters up to his bench to get a new one and saunters back again to install it. He watches several men try to lift a casting without success. They have to go to the labor foreman for a man to help them. "It's no use asking the electrician; he'd get his hands dirty." That's just the trouble, he's afraid of getting his hands dirty or soiling his clean overalls. When visitors come to the plant he tries to leave the impression that he holds some sort of exalted position, a job a little better than the other fellow's. He wonders why the company doesn't feel the same way about it when pay day comes around, or why some other shop is paying the electrician a salary far in excess of his. He, at least, seems to think he is making good his bluff.

If you were the manager of a plant too small to maintain an electrical engineer, what would you give for a man who would apply himself to the study of your electrical equipment during his idle time? For instance, if when another machine was to be installed, he came to you and informed you that the motor running such and such a lineshaft had a capacity load and would not carry the new equipment, giving you the figures? Such a man might cost you a new motor and save you your old one. You would be ahead in the long run.

If a certain type of starting box were not adapted to local conditions, who should know it better than your electrician? If a new motor was to be installed, why shouldn't he know what construction would be necessary to bring power to it, and why shouldn't he be able to do the work as well, including the installation and setting of the motor?

The electrician's job in the small and medium sized machine shop today is just what that individual makes it. The day of spare-time study is here, and coupled with practical experience where can a wage earner get a better training for something bigger and better? Why should the growing plant go outside for the chief electrician when it has reached the turning point toward success? There might be at hand a practical man thoroughly acquainted with the plant's equipment—a man who not being contented with being a dub all his life, had fitted himself for something better.

Industrial Cost Accounting for Executives

By PAUL M. ATKINS

The fifteenth article of the series—Composition and disposition of administrative and selling expenses — Outside service costs — Analysis of advertising

ADMINISTRATION and selling expenses are often grouped together for discussion and that plan has been followed here for the sake of convenience. It must not be thought from this arrangement, however, that these two groups of expenses are to be treated in all respects alike. From the point of view of industrial cost-accounting they do have this in common, it is true, that they both differ in their incidence and disposition from manufacturing expenses. Selling expenses are entirely a cost of selling, while administrative expenses represent partly a service to selling and partly to production and, in some cases, a service to the business as a whole which can be attributed to either. Let us first consider the composition of the various accounts in the groups before passing on to a brief study of their disposition.

There are a number of accounts which are similar in many respects to those discussed in the preceding article. The part of the building occupied by the departments in question, together with their equipment must be maintained quite as well as the same class of assets in the factory. Of course, in the office departments there is seldom anything like the amount of work of this kind to be done that there is in the factory, and so the extensive subdivision of the maintenance accounts which was discussed in the preceding article is not needed here. Usually one account will be sufficient except, possibly, for such a department as the experimental department when it appears in this group. In such a case, the same accounts will be needed as for a factory department.

Offices Must Be Kept in Good Shape

It must not be thought from what has just been said, that the maintenance work of selling and administration departments is a wholly insignificant item which can be neglected in the cost records. The office must be cleaned with considerable frequency, the general appearance of this section of the building must be kept in much more attractive shape than is necessary for the factory. With the introduction of modern methods of record keeping there has come the extensive employment of machines of various kinds—typewriters, adding machines, billing machines and calculating machines—and all of the equipment must be kept in satisfactory condition. There is not a department in the two groups which does not require a maintenance account.

Every department requires the services of individuals to carry on its various functions, and hence, wages and salaries must be paid. With the exception of the remuneration of the salesmen, there is practically none of this which can be treated satisfactorily as direct wages. Occasionally, in the drafting or experimental departments orders are issued in such a form that the time of those working on them can be charged directly to them, and under such conditions when these departments are in the administrative group, there is also the possibility of an exception here. The distinguishing characteristic of these departments in respect to labor costs in contrast to the factory departments is that in the former most of the labor is indirect. In general, however, it is not necessary to subdivide the account because the debits to be made to it are sufficiently homogeneous to render that unnecessary.

Division of Salaries

The principal problem which comes up in connection with the account is the division of the salaries of those individuals who render services in more than one department. If their time is divided in an easily measured manner, then the salaries can be allocated in the same proportion. If such is not the case, then it becomes necessary to estimate the distribution. The estimate should be made by several persons independently and the results compared in order to eliminate personal reactions as far as possible.

Supplies is another account which will be found in most departments. Pencils, paper and ink seem like small items, but they all count up in the long run. Printed forms, in particular, are costly and their use should be controlled. It is expensive not to use printed forms when their employment would result in the reduction or elimination of errors, but to use them for scratch pads as is so often done by clerks, should be entirely forbidden. It is quite desirable that each department should be made responsible for its own consumption of such materials.

A reclamation of errors account should appear in the classification for most departments. It must not be thought for a moment that the factory is the only section of the business that can make costly mistakes. An error on the part of a clerk in the order department may result in incorrect instructions being transmitted to the planning department, and as a result large quantities of goods may be made up which do not meet the customer's requirements and must be scrapped. It is only appropriate that the department which made the mistake should be charged with its cost, and that the factory or the business as a whole should not promiscuously bear the burden.

The point may seem insignificant but a little analysis will show that it has considerable bearing on the control

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of the business. Many a manager will insist on having capable employees in the factory and energetic salesmen on the road, and is willing to pay liberally for them. Yet, he will often try to operate his business with the cheapest possible clerical labor in his office—cheapest in the sense of wages paid and services rendered, but often the most expensive in the long run. An account of a kind which indicates unmistakably the cost of his policy will give him some idea of the inefficiency of such methods and enable him to form some idea of the importance of such work.

If the chief executives will be perfectly frank with themselves, such an account should appear in the executive department and, if justly used, it will often show large amounts from time to time. When executives make mistakes, and even the best of them do from time to time, they are apt to be the most expensive of all.

Telephone and Telegraph Expense

There are certain other accounts which appear in some of the departments that are rarely or never met with in the factory departments. Telephone and telegraph charges are among them. The sales department, traffic department, executive department, and often the purchasing department are the ones which most extensively make use of this convenience. It is usually not difficult to record the source of the outgoing long distance calls and telegrams and so to correctly apportion the charges. Of course, most departments make use of inside telephone connections, and the cost of such service can be distributed on the basis of the number of telephones in each department. Often, the charge is on a rental basis and so can easily be incorporated with the fixed charges.

The progressive manager generally realizes that he is not omniscient and neither are his associates or employees. Hence, he is increasingly making use of outside services of various kinds, some of which are already well established as sound business practice. Few concerns go for any great length of time without having their books of account audited. That is primarily a service to the accounting department in checking up its work, and through it to the business as a whole.

There are very few concerns whose credit departments are not equipped with service rendered by either Dun or Bradstreet and often with both. The executive department is usually provided with reports such as Babson's or Brookmire's, and frequently industrial engineers, lawyers and other specialists are called upon for advice. All the various departments which avail themselves of such services should be provided with expense accounts to which the costs thereof may be charged.

It sometimes happens that a business is built up by the efforts of a few individuals. This is, of course, the ordinary way of development in the case of a partnership, but it holds true also for corporations. Under such circumstances it is often of vital importance to the company not to lose the services of these individuals, and if they are lost for any reason, the balance sheet is likely to be affected adversely. It is not possible to protect against possible severance of connection for all reasons, but is is possible to insure against financial difficulties due to the death of the person holding the key position, and this is often done. The premiums of the life insurance policy are paid by the company and are properly an expense of the department in which the person works. Hence, an expense account should be provided. Of course, on the death of the person insured the company receives the amount of the insurance which it has carried to use in any way needed to meet the emergency.

When we come to the selling departments we find that there are several kinds of expenditure which differ from those already considered. In certain respects the work of these departments is analogous to that of the manufacturing departments. We often speak of the salesman *making* sales and in so doing we indicate that similarity. Just as we have *direct* costs of production so we also have *direct* costs of sales. The whole subject is rather outside the scope of this series of articles, but a few words devoted to some of the more outstanding features of the problem may aid in getting some grasp of the situation. The question of selling costs is a subject as large in many ways as that of production costs, which will be treated in the series.

We may think of the salesmen's salaries, their commissions, traveling expenses and such other items as bonuses, as being the direct cost of selling, for they can be allocated with some definiteness against the sales which result from the efforts of the salesmen. These different forms of remuneration should be charged directly against the cost of selling and not debited to the wages and salaries account in the sales department. The same thing should be done with the traveling expenses in charging them to cost of selling and not to some expense account of the sales department. It should not be inferred from the foregoing that there should be no traveling expense account for the sales department because it is usually necessary to carry such an account to take care of the traveling costs of the sales manager himself.

Advertising and the Advertising Department

The advertising department also offers some interesting questions. One of these is in connection with the cost of advertising. Should it be treated as a part of the expense of the department or not? A little analysis will reveal that the amount paid for advertising is not a part of the cost of operating the department. It is the result of the operation of the department, it is true, and the ratio of this expenditure to the returns obtained is one way of measuring the departmental efficiency, but it can hardly be considered an expense of operation. If it is not a cost of operation, then it should not be treated as a departmental expense, though it may, under certain circumstances be entered as a non-assignable expense. The most satisfactory way to handle such an item is to charge it to an advertising account at the time the expenditure is made. It can then be credited to the account and debited to any account which may appear appropriate. Perhaps the most suitable place to allocate it is to the cost of selling directly without passing it through any other account.

There are several details which ought to be remembered in connection with the expenditure. The full effect of advertising is often not felt till sometime after publication. Hence, it is sometimes distinctly incorrect to charge off the entire cost of advertising in the period in which it appears. It also happens that in some cases a single article of a whole line is advertised, but in trying to ascertain the cost of selling the goods it must not be forgotten that much of the benefit of the advertising is shared by the entire line and even by the business of the company as a whole, and hence, the entire cost of the advertising should not be allocated

against the single article which is especially stressed therein.

Of course, the selling departments have many other expense accounts like those of other departments already described, such as accounts for maintenance, supplies, insurance and fixed charges. Taken altogether with any other additional special expense accounts, means are provided for the costs of operation of this group of functions of the business.

The Disposition of Selling and Administrative Expense

When accounts have been provided for the recording of the different administrative and selling expenses, the next question which arises is in regard to their disposal. Probably, the commonest as well as the simplest method of dealing with the problem is to charge them off to profit and loss. This enables the books to be closed and disposes of the expenses so that the next month's transactions may be recorded, but it can hardly be said to aid very much in the control of the business.

What the executive wants to know is the cost of manufacture, the cost of selling and the wasted production and sales capacity. Methods have been developed for dealing with the problems in so far as production is concerned, some of which will be discussed in succeeding articles. In regard to sales, however, very much less has been accomplished in that direction. Some steps, it is true, have been taken toward allocating the selling costs against the sales. It may be done by debiting to a trading account the total of the controlling selling expense account, adding the cost of advertising for the period and salesmen's remuneration and expenses. In some cases, too, a certain share of the administration expense account is also debited. It is correct in so far as it accomplishes the segregation of expenses concerned only with selling from those which form a part of the costs of production, but it is lacking in that it does not distinguish between the utilized and unutilized sales capacity.

This is not such a serious problem as the same one in regard to production, because in dull periods it undoubtedly does cost more to make sales than in the busy cycle when salesmen are often hardly more than order-takers. It is not fully satisfactory, however, and it is to be hoped that commercial cost-accountants will progress as rapidly in the solution of this problem as industrial cost-accountants have with their form of it during the last few years.

If this last described method is employed—and it seems to be about the best in use at present—the trading account will appear somewhat as follows:

Trading Account

General journal (amount of cost of sales. Credit therefor to merchandise account.)

General journal (amount of selling expenses. Credit therefor to selling expense account.)

General journal (amount of advertising chargeable in period. Credit therefor to advertising account.)

General journal (amount of direct selling cost. Credit therefor salesmen's salaries account and salesmen's expense account.)

General journal (part of administration expenses. Credit therefor to administration expense account.)

General journal (balance of this account closed into profit and loss account. Credit therefor to profit and loss account.)

General journal (amount of net sales. Debit therefor to general sales account.)

The disposition of that portion of administration expenses which represents the costs of the benefits of these functions to production is discussed in a later article in which the distribution of manufacturing expenses is treated.

While only a very little space has been given to the investigation of selling expenses, the executives must remember that it is quite as necessary to control these expenses, and that they can give him as much information for the guiding of his policies as the manufacturing expenses. A series as long as the present one would be necessary to deal adequately with the subject.

Why Make Square-ended Pins?

By John R. Godfrey

There's something mighty queer about the inner workings of the alleged brains of those who inflict motor cars on the over-anxious public. It looks almost like a conspiracy on their part to increase the income and well-being of garages and the men who infest them. There are exceptions, of course, but after the average man looks over my car for any reason, I go over it pretty carefully myself to see how many cotter pins he has left out, or taken out. I've been even more particular about this since I had a wheel come off out on the road, because the tried-and-trusted employee of a well known firm had left the cotter out of the axle end. And, as I find it more comfortable for all concerned to have four wheels on the bus, I always inspect for cotter pins after a visit to the so-called automobile service station.

The designers, however, seem to make it as difficult as possible to do a little job yourself. Brake rod pins, for example, almost invariably have the ends square instead of chamfered. It's easy enough to slip them through the holes in the rod and clevis when everything is new and the body isn't on the chassis. But when something lets go on the road and you crawl underneath the car, its a different story.

Square-ended pins don't go into place worth a cent unless everything is in line, and it's no great joy to lie in the road with both hands working at the vitals while choice gobs of oil drop into your eye, or otherwise decorate your beautiful countenance. It's then that the maker of square ended pins gets blessed good and plenty. Even a slight chamfer on the end helps and a taper, for perhaps a sixteenth of an inch, is a real joy. It ought to be a jail offense to make 'em any other way.

Annual Report of Engineering Foundation

Civilization must choose between research and going back, it is asserted in the annual report of the Engineering Foundation, which, reviewing the eight years of its history, finds that, particularly as the outcome of the War, research effort is growing among American engineers, industrialists and business men.

Founded by Ambrose Swasey, a Cleveland manufacturer and a native of New Hampshire, with an endowment of $500,000, the Foundation in the report, made public by Chairman Charles F. Rand, tells of numerous achievements accomplished during the past year in association with the National Research Council and other agencies.

Proposed Definition of Terms Relating to Metallography

AS AN indication of the growing realization of the importance of standardized nomenclature in different lines of engineering, we print the proposed definitions of the American Society for Testing Materials regarding Metallography. These definitions have not yet been adopted and must not be considered as standard until further action has been taken. Criticisms of these tentative definitions are solicited and should be sent to G. F. Comstock, Secretary of Committee E-4, Titanium Alloy Manufacturing Co., Niagara Falls, N. Y.

Alloy.—A union, possessing metallic properties, of two or more metallic elements, or of metallic and non-metallic elements, which are miscible with each other, at least to some extent when molten, to form a homogeneous liquid and do not separate into distinct layers when solid.

NOTE.—Such combinations when cold may consist of mechanical mixtures, eutectics or eutectoids, solid solutions, or chemical compounds, one or more of which may exist at the same time.

Alpha Brass.—A copper-zinc alloy with a copper content greater than approximately 64 per cent. It is composed of but one type of crystals all of which are of the same composition.

Beta Brass.—A copper-zinc alloy with a copper content of approximately 54 per cent, composed of but one type of crystals all of which are of the same composition.

NOTE.—At ordinary temperatures, the normal range of beta brass is from 51 to 55 per cent copper. Quenching from higher temperatures considerably broadens this range. Between 64 per cent copper and 55 per cent copper, the copper-zinc alloys consist of mixed crystals of alpha and beta, the relative proportion of which depends upon the composition and heat treatment. When rapidly cooled from high temperatures (that is, from at or near the melting point) mixed alpha and beta may occur with copper as high as 70 per cent.

Etching Reagent.—A substance or reagent used to reveal the structure of a metal or alloy causing a difference in the appearance of different constituent parts or different grains.

NOTE.—This substance is usually a solution of the reagent in water, acid or alkali, but etching may in some cases be brought out by a differential oxidation produced by "heat tinting."

Equi-axed.—This term is applied to the grains of a metal or alloy after solidification and to grains of metals or alloys which have been strained and allowed by a process of suitable annealing to assume a condition approaching crystalline equilibrium.

Equi-axed Grain.—An unstrained grain which has approximately equal dimensions in all directions.

NOTE.—This term is practically restricted to unstrained metals.

Grain.—A term used for an allotrimorphic crystal present in metals and in one-constituent alloys.

NOTE.—Although a crystal may show division by "twinning," etc., it is regarded as the grain rather than smaller sub-divisions. In the case of alloys of more than one constituent, the crystal which, by its transformation, gave rise to these constituents is taken as the grain when its limits are still discernible; if the limits are not discernible the individual constituents are considered as grains.

Grain Size.—This is preferably expressed as the number of grains per unit area of cross-section. The average cross-sectional area of the grain may also be given or the average dimensions. Grain size of strained material is expressed by the average number per linear unit in two directions, or by the average number per unit cross-sectional area, together with the ratio of length to breadth (L/B).

NOTE.—By the "intercept" Method for grain count, the number of grains and fractions of grains along a line of known length on two axes at right angles to each other are counted. By the "Planimetric" Method for grain count, the number of grains and fractions of grains within a definite area are counted.

Intercept Method for Grain Count.—See note under Grain Size.

Macrograph.—A graphic reproduction of any object which has been magnified not more than 10 times.

NOTE.—When it is desired to indicate that it is a photographic reproduction, the term "photomacrograph" may be employed.

Magnification.—The ratio of the size of the image to that of the object, based on linear dimensions, and generally expressed in "diameters," thus: ×100 or 100 diameters.

Metal.—Any of the metallic elements, either of very high purity or of ordinary commercial grades.

NOTE.—Brass or other alloy is a metal in the commercial sense, but an alloy in the scientific sense.

Micrograph.—A graphic reproduction of any object magnified more than 10 times.

NOTE.—When it is desired to indicate that it is a photographic reproduction, the term "photomicrograph" may be employed.

Muntz Metal.—A term often loosely applied to a brass, i.e., a copper-zinc alloy, that can be mechanically worked while hot. Originally applied to brass of the composition: Copper, 60 per cent; zinc, 40 per cent; such brasses consist of a mixture of two constituents termed "alpha" and "beta."

Planimetric Method for Grain Count.—See note under Grain Size.

Modern Agricultural Implements in Egypt

Imports of agricultural implements into Egypt in 1922 were valued at $319,921, an increase of nearly 50 per cent over 1921, when imports were valued at $219,682, says the Agricultural Implements Division of the Department of Commerce. Notwithstanding this increase, these figures indicate a backward trend in the use of implements in Egypt as compared with pre-war years. Imports in 1913 amounted to $1,329,725, while in 1920, which was a boom year in Egypt and when money was plentiful because of the high prices obtained for the cotton crop of that year, imports amounted to only $636,836, which was less than half of the amount imported in 1913.

Cheap and abundant labor and the conservatism of the native farmers serve to restrict the use of modern implements. Deep plowing is not required as the soil is regularly renewed by flooding. Numerous canals are required by the irrigation system and consequently the land is divided into small sections. The native types of implements which have been used for centuries appear entirely satisfactory, and can be purchased at a comparatively low cost. However, there is a spirit of progress noticeable in some sections of the country and implement makers consider the future as hopeful.

Bookkeeping for the Small Plant

By C. J. MORRISON

The requirements for setting up a bookkeeping system—Numbering accounts, checks and stubs—Making entries in purchase book and ledger—Drawing up statements

A SHORT time ago a small manufacturer went to his bank and asked one of the officers to help him make out his income tax report, and, as this is a service rendered by the banks, the officer gave a ready consent. However when the manufacturer began to unpack a large satchel and to place stack after stack of canceled checks upon the desk the bank officer began to wonder what kind of a task he had undertaken and he did not feel at all assured by the explanation, "The checks show my expenses while the monthly statements of deposits give the receipts and the difference is the profit for the year." When asked about the inventory and other capital expenditures, the manufacturer replied, "I think the inventory was about the same at the end of the year as at the beginning, and no additional equipment was purchased during the year." The task could not be performed during banking hours, but ran far into the night as well as taking all of a Saturday afternoon and when completed was of doubtful accuracy.

If this manufacturer was the only one who kept his books in such a manner, no more thought need be given to him, but unfortunately he is one of many. Yet for a small establishment to keep the accounts properly is a very simple matter which requires little time and no special training.

Dismissing the question of inventory for the present and considering only the regular bookkeeping, all that is required is a check book, invoice blanks, two dozen folders for filing, a large loose-leaf binder to take sheets about 11x14 in. and, for the binder, a supply of paper ruled with many columns. The folders should be marked two for each month in the year and one set labeled, "Bills Payable" and the other "Accounts Receivable."

Numbering the Accounts

As bills are received they should be numbered consecutively and placed in the folder for the month when they were received. A convenient way to number is to use for the first part, the number corresponding to the month and for the last part the bill's individual number; thus 101 would be the first bill received in January, 110 the tenth received in January, while 1001 and 1010 would be the first and tenth bills in October. The system allows 99 bills to be received in each month which is probably enough for a small establishment, but if such is not the case, a start should be made with 1001 which allows for 999 bills each month. In the latter system the first bill in October would be 10001.

Just so far as possible all bills should be paid by check and the number of the check should be placed on the bill which it pays. A few items such as street car fares and postage cannot be paid by check, but must be handled through the "Petty Cash." An easy way to handle these matters is to draw a definite amount of money for petty cash, keep an account of the money spent and each week draw a check to reimburse the

						AMOUNTS DRAWN	
No 118	Date March 8 1923						
Favor of Power & Light Corp							
For 303						24	50
No 119	Date March 8 1923						
Favor of Cash							
For 304						225	00
No 120	Date March 9 1923						
Favor of G. B. Brass Co						245	00
For 305							
					Total Checks Drawn	494	50

Date 1923		DEPOSITS		Balance Brought Forward	1	078	82
March	5	Richard Roe & Co	210			51	00
	6	The Specialty Co.	215			206	05
	8	Rex Mfg. Corp.	218			343	00
				Total Deposits	1	678	87
		Deduct Checks Drawn, Nos.	118-119-120			494	50
				Balance Forward	1	184	37

FIG. 1—ENTRIES ON CHECK BOOK STUB

petty cash. A regular bill should be made for this disbursement, numbered, and placed in its place in the proper folder. Such a bill for a typical week might appear somewhat as follows:

No. 308
PETTY CASH

Street car	$2.10
Postage	1.08
Delivery charge	.35
Total	$3.53

Ck. 216

The entry "Ck. 216" shows the number of the check with which the bill was paid.

Invoices should be numbered in the same manner as the bills and a copy of each invoice should be placed in the accounts receivable folder for the month in which it was issued.

The checks and their corresponding stubs should be numbered consecutively and the stubs should show the amount of each check drawn, to whom payable and for what bill. The stubs should also show the amount of

PURCHASE BOOK MONTH OF March 1923

Date 1923		Bill No.	Ck. No.	Description	8+9+16 Accts. Payable Total 1	Rent 2	Payroll 3	Small Tools and Supplies 4	Light and Power 5	Freight, Express and Delivery 6	Repairs 7	2 to 7 Inc. Factory Sub-total 8	10 to 15 Inc. Adm. Sub-total 9
Mch.	1	301	113	Cons. Realty Co.	100 —	100 —						100 —	
	2	302	114	City Supply Co.	20 75			10 75				10 75	3 10
	7	303	115	Power & Light Corp.	24 50				24 50			24 50	
	8	304	119	Cash	225 00		225 00					225 00	
	8	305	120	A. B. Brass Co.	250 00								
	9	306		Home Box & Lumber Co.	55 10						25 10	25 10	
	9	307	121	National Trucking Co.	3 50					3 50		3 50	
	10	308	122	Petty Cash	3 53					35		35	3 18

FIG. 2 (a)

Salaries 10	Office Supplies and Expense 11	Sundry 12	Travel and Hotel 13	Ins. and Taxes 14	Advertising 15	Capital Sub-total 16	Mdse. 17	Equipment 18
	3 10					15 00	15 00	
						250 00	250 00	
						30 00	30 00	
	168		2 10					

FIG. 2 (b)

FIG. 2—PURCHASE BOOK

each deposit, from whom received and to what invoice the amount applies. A typical stub is illustrated in Fig. 1. The figures after the names show the numbers of the bills and invoices to which the checks and deposits apply. All receipts should be deposited even though some may be in cash and cash is withdrawn at the same time. No checks should be drawn for personal bills, but a separate bank account should be kept for such matters.

As bills are paid the check number should be written on each bill and, similarly, as payments of invoices are received the check number, bank and date should be written on each invoice or if the payment is made in cash, this fact and the date should be recorded. A typical record on a payment made by check would be as follows: "1026,M&M., Newark, N. J. 3/5/23."

The Purchase Book

Two pages of the loose-leaf book which face each other should be made out somewhat as illustrated in Fig. 2, a and b, but with whatever changes may be necessary to satisfy the requirements of the business. One firm may own the property and not need the "rent" column, while some other concern may wish several columns for merchandise so as to keep separate accounts of different items.

As each bill is received it should be assigned a number and entered in the purchase book, but the check number should be left blank until the bill is paid. Typical entries would be as shown where bills 301 to 305 inclusive, 307 and 308 are paid and 306 has not been paid. At the end of the month all of the columns should be footed up and the totals entered at the bottom of the page. The total of column 1 should equal the sum of the totals of 8, 9 and 16 and if it does not, there is a mistake which must be found. However, if care is used in making the entries, there will be little or no trouble at the end of the month.

As checks are drawn to pay the bills, corresponding entries should be made on the credit (cash paid out) side of the ledger as shown in Fig. 3. The column headed "net cash" should show the amount for which each check is drawn while the "accounts payable" column gives the amount of each bill and when there is

MONTH OF March 1923 CASH PAID OUT Cr.

Date 1923		Details	Bill Number	Net Cash	Disc.	Accts. Payable
Mch.	1	Cons. Realty Co.	301	100 00		100 00
	2	City Supply Co.	302	20 50	50	20 75
	7	Power & Light Corp.	303	24 50		24 50
	8	Cash	304	225 00		225 00
	9	A. B. Brass Co.	305	245 00	5 00	250 00
	9	National Trucking Co.	307	3 50		3 50
	10	Petty Cash	308	3 53		3 53

FIG. 3—CREDIT OR CASH PAID OUTSIDE OF THE LEDGER

Dr. MONTH OF March 1923 CASH RECEIVED

Date 1923	Details	Net Cash	Disc.	Accts. Rec.	Interest	Miscl.	Capital
Mch. 1	Balance	400 00					
2	Rex Mfg. Corp.	101 50		101 50			
5	John Doe Co.	105 60	2 15	107 75			
	Richard Roe & Co.	51 00		51 10			
6	The Specialty Co.	206 05	4 20	210 25			
8	Rex Mfg. Corp.	343 00	7 00	350 00			
	Bank	5 00			5 00		
	Cash Sale of Scrap	3 70				3 70	

FIG. 4—DEBIT OR CASH RECEIVED SIDE OF THE LEDGER

no discount the two entries are the same. The entries should be footed up at the end of each month and the sum of the totals of the net cash and discount must equal the total of accounts payable. Also the total of column 1 of the purchase book less the total of the bills not paid must equal the total of the accounts payable on the ledger.

As payments of invoices are received entries should be made on the debit (cash received) side of the ledger as shown in Fig. 4. Care should be taken to enter under "net cash" the exact amount received while the discounts deducted are shown under "discount" and the amount of the invoices paid, net cash plus discount, under "accounts receivable." At the end of the month the total of the net cash on the debit side less the total of the net cash on the credit side gives the balance to be carried forward to the next month and this balance should be the same as the balance shown in the check book, which in turn must check with the statement from the bank.

Annual Statement Easily Drawn

At the end of the year a statement, itemized to meet the requirements of the government, can be made up in a very short time. The only item missing is that of inventory and a simple method of keeping it will be given in another article. Moreover, a statement can be drawn off at any time to show the owner the exact status of the business. The items in the purchase book which bear no check number show the outstanding bills (accounts payable) while the invoices which have not been marked as paid give the accounts receivable.

A statement as of March 1, 1923, might appear as follows:

ITEMS		WHERE OBTAINED
Assets		
Cash	$900.00	Debit side of ledger and check book.
Accounts receivable.	3,250.00	Invoice folders.
Merchandise	10,215.00	To be described later.
Total quick	$14,365.00	
Machinery and fixtures	5,225.00	Value before books were started plus purchase book entries under "quipment."
Total	$19,590.00	
Liabilities		
Accounts payable	2,125.10	Items in purchase book without check numbers.
Reserve for dep.	1,045.10	Predetermined rate to be written off each month and the total to date used in the statement.
Capital invested	14,000.00	Items in ledger under "capital."
Total	$17,170.20	
Surplus	2,419.80	
	$19,590.00	

Little work is required to draw off a statement of this sort each month and the increase in the surplus will show the profit made. Also in case there is occasion to borrow money, the most recent one of these statements can be presented to the bank and will be found to satisfy its requirements.

Depreciation of a Lathe—Discussion

By W. T. Bowker

On page 694, Vol. 58, of the *American Machinist*, appear a few remarks upon the sound value or going value of a lathe as compared to its sale value, and I merely wish to state that Mr. Thwing's conclusions in this matter are extremely sound and follow the accepted practice of almost all appraisal companies.

As a usual thing, the owner of a factory is more interested in what might be termed the "utility value" of his equipment than he is in the amount of money it would bring on the market when considered as second hand equipment, and in most cases the securities commissions who administer the blue sky laws of various states have come to the agreement that the utility value of a lathe, or of a complete plant, is the value to the public asked to buy the plant in the form of preferred stocks, bonds, and other securities.

In my experience in the appraisal business I have found, on numerous occasions, machines which, considered from the viewpoint of their sale value or salvage value, were worth absolutely no more than the scrap metal price of the machine delivered at the melting cupola, but the machines were used and useful and the owner was obtaining production from them. They had utility to him, and for that reason it was necessary to assign a certain value to them.

I remember one factory which I appraised that was in the business of making sewing machines. There was a battery of Lincoln milling machines which had been used to produce rifle parts during the Civil war. Those machines were used to make small sewing machine parts and were every bit as efficient and useful to their owner as new machines that he could have purchased. They could have been sold to but very few other manufacturers or even second hand dealers for any more than their junk value.

Too much confusion exists in the minds of many people on what constitutes value, but I think it can be safely stated that in most cases the value to be determined is the value in use and not at all how much the thing valued would bring in the second hand market, or under forced sale or liquidation.

TABLE XXV

France—Imports of Machine Tools

"Machines-Outils"

Countries of Origin	1909		1910		1911		1912		1913		*1914		1915	
	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs
Sweden														
Great Britain	28,874		29,908		30,605		38,247		50,920				44,909	
Denmark	77,666		79,008		89,197		116,965		120,439				901	
Germany														
Saar Basin	14,293		13,058		16,279		26,621		24,517					
Belgium														
Netherlands	4,548		3,458		2,715		3,764		5,499				19,009	
Switzerland														
Czecho-slovakia	14,932		21,455		30,195		35,620		44,558				218,431	
United States														
Canada													2,383	
Spain														
Brazil													624	
Italy														
Norway														
Other foreign countries	2,682		2,878		2,594		3,311		3,236				988	
Total	142,995	29,313,975	149,765	30,701,825	171,585	35,174,925	224,528	46,028,240	249,169	51,079,645			288,045	177,147,675
Colonies and Protectorates	36	7,380	18	3,690	7	1,435	3	615	27	5,535			28	17,220
TOTAL	143,031	29,321,355	149,783	30,705,515	171,592	35,176,360	224,531	46,028,855	249,196	51,085,180	152,303	31,222,115	288,073	177,164,895
Average Exchange Rates		.193		.193		.193		.193		.193		.199†		.182
Value in U. S. Dollars		5,659,021		5,926,164		6,789,037		8,883,569		9,859,439		6,213,201		32,244,011

* No detailed statistics available for 1914.
† Seven months' average.

Countries of Origin	1916		1917		1918		1919		1920		1921		1922	
	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs	Q.M.	Francs
Sweden	981		733		118		2,407		4,461					
Great Britain	65,198		125,073		86,760		76,404		91,178					
Denmark	478								4,082					
Germany							*4,911		*139,492					
Saar Basin							1,080		1,315					
Belgium					633		10,477		93,105					
Netherlands									1,152					
Switzerland	76,614		41,396		22,147		32,768		46,055					
Czecho-slovakia									2,983					
United States	324,554		378,061		180,165		208,679		184,727					
Canada									3,133					
Spain	5,364		3,762		870		2,321		1,127					
Brazil	305													
Italy	536		899		1,010		1,569		10,688					
Norway			174											
Other foreign countries	470		739		95		1,736		795					
Total	474,500	291,817,500	550,837	338,764,755	291,798	179,455,770	341,552	230,547,600	584,293	584,293,000				
Colonies and Protectorates	226	138,990	92	56,580	47	28,950	936	631,800	241	241,000				
TOTAL	474,726	291,956,490	550,929	338,821,335	291,845	179,484,675	342,488	231,179,400	584,534	584,534,000				
Average Exchange Rates		.170		.173		.178		.135		.070				
Value in U. S. Dollars		49,632,603		58,616,091		31,948,272		31,209,219		40,917,380				

Q.M. = Metric quintal = 100 kilograms = 220.46 lb.
* These figures include reparations shipments.

Simplification of Paper Sizes

Abstract of report of the Sectional Committee on Book and Magazine Paper to the Committee on Simplification of Paper Sizes appointed by the Bureau of Standards, Department of Commerce

FOLLOWING upon the report of the Committee on the Elimination of Waste in Industry of the Federated American Engineering Societies, it was revealed that further studies of the more intimate detail of the various elements that enter into the equation, such as raw materials, would prove that further elimination of waste, through simplification and standardization methods could be effected.

In August, 1921, the Department of Commerce appointed a committee to investigate the size and grade situation in the manufacture and use of printing papers. This committee made a report showing existing sizes of publications and mailed out 20,000 copies with a questionnaire requesting criticisms and suggestions.

In September, 1922, the general committee was sub-divided into sections, and the report being considered here is that of the sectional committee investigating the situation now existing in the book and magazine paper field.

> At one time there were sixty different sizes of a certain type of machine, but through exhaustive research and with the help of the paper manufacturer, publisher, printer, and binder, this has been reduced to six, thus simplifying and economizing the production of printing and binding, as well as eliminating waste in material and human effort.

The latest statistics available through the Federal Trade Commission, Department of Commerce, and the American Paper and Pulp Association, show that slightly over 1,000,000 tons of book and magazine paper are produced annually in the United States, in which production there are utilized 258 book paper making machines, ranging in width from 56 in. to 196½ in., and having a total estimated capacity of 3,849 tons per 24-hr. day. A quick mental analysis of this vast range in widths implies immediately to our minds the vast changes that have taken place in the past fifty years in the development of paper making machinery, and the total lack of standardization, as well as the variations of opinion as to the flexibility of these machines and what is the best practice as to width sizes. It must be remembered that paper making machines are of tremendous proportions as to length and take up considerable space and investment in paper mills, and determine the contributory factors, such as water pulp conveying devices, digesters, beaters and all the elements that enter into the securing of the finished product, namely, paper in rolls. From this basis the recommendations contained in this report must originate.

The statistics given in the report show that there are many more violations of the recommended standard sheet and roll width sizes in the magazine field than now exist in the jobbing or commercial fields, which in turn accounts largely for the conditions reported in the printing industry by the committee on elimination of waste in industry, when they stated that "the United Typothetae of America by actual survey throughout the country estimated the over-equipment of printing machinery at from 50 to 150 per cent, representing hundreds of millions of dollars of idle equipment," due to a large extent to lack of standardization. In another part of the report on waste in industry it is stated that at one time there were sixty different sizes of a certain type of machine, but through exhaustive research and with the help of the paper manufacturer, publisher, printer, and binder, this has been reduced to six sizes to meet all practical needs, thus simplifying and economizing the production of printing and binding, as well as eliminating waste in material and human effort.

The information compiled shows that there are today 441 different sheet sizes and 93 different roll widths of book paper being used in the magazine publishing field alone.

The committee's idea in submitting the detailed reports has been to so arrange these varying page sizes into groups that they will fit into the range of the suggested sheet sizes and thus carry back, by the slightest variations, while still retaining their general appearance, this standardization to the paper machine itself. The present conditions appear to be unintentional, arising from a lack of guidance and as a result of custom which has been crystallized into habit and needless prejudice, but we feel that these objections can be removed by education and appeal to self interest and the benefits to be obtained. Certainly the advantages far outweigh the drawbacks.

The most economical or ideal production of book paper would be with the elimination of all orders requiring less than a 24-hr. run of a paper machine, which would amount to from 20 to 25 tons per day, depending upon their minimum special direct-making-order trade customs to a 24-hr. machine run for a size and weight. Through a reduction in the present wide variety of paper sizes substantial savings would be made in the cost of printing, printing machinery manufacture as well as in paper costs.

Those sizes and roll widths given in the recommendations should therefore be used as guides for the elimination of paper orders that call for less than 25-ton orders or a 24-hr. run for a book paper machine of the ordinary type.

It is also to be remembered that while to the large users of paper who are in a position to have their paper manufactured especially for their own requirements, the full weight and purport of this report will not be of immediate concern, it should be realized that the benefits to be derived from a general standardization of various printed forms would result in great benefits to advertisers, lithographers, machine manufacturers, printing production generally, as well as in paper making machines for paper mills.

Therefore the committee wishes to submit here its recommendations for sheet sizes in their single and doubles, as well as rolls, as outlined in the accompanying table, in which are given a broad range of untrimmed page sizes that will cut to advantage from the sheets as given, and will be the first step toward effecting the savings that are possible by adherence to this program.

RECOMMENDED SHEET SIZES AND ROLL WIDTHS FOR UNTRIMMED PAGE SIZES

Sheet Sizes—Single	Sheet Sizes—Doubles	Untrimmed Page	Untrimmed Page	Untrimmed Page
	37 x 49		6¼ x 9¼	9¼ x 12¼
26 x 29	29 x 52		7¼ x 13	13 x 14½
25 x 38	38 x 50	4⅜ x 6¼	6¼ x 9½	9½ x 12½
28 x 42	42 x 56	5¼ x 7	7 x 10½	10½ x 14
28 x 44	44 x 56	5½ x 7	7 x 11	11 x 14
30½ x 41	41 x 61	5¼ x 7⅝	7⅝ x 10¼	10¼ x 15¼
32 x 44	44 x 64	5½ x 8	8 x 11	11 x 16
33 x 46	46 x 66	5⅝ x 8¼	8¼ x 11½	11½ x 16½
35 x 45½	45½ x 70	5⅛ x 8⅝	8⅝ x 11⅜	11⅜ x 17½

ROLL WIDTHS

25, 28, 30½, 32, 33, 35, 37, 38, 41, 42, 44, 45½, 46, 49 50, 56, 61, 64, 66 and 70.

Untrimmed sizes are given because of the lack of standards in trimming and also because of variations in trim due to some publications being side-wired and others saddle-stitched. The average trim off the above sizes is ⅛ in. off head and ¼ in. front and bottom.

The four sizes included in this list, 26x29, 25x38, 32x44, 34x45½, and their doubles, are the sizes the committee on simplification of paper sizes has recommended for general printing use and for jobbers to stock.

Greek Industries Gaining Ground

The textile industry in Greece is rapidly gaining ground and promises to become of the utmost importance to the country within the next few years, according to advices received by the Department of Commerce. This industry includes the manufacture of cotton, wool, and silk fabrics, and hemp and jute products. It is believed that the large influx of refugees will have the effect of transplanting the carpet industry of Asia Minor into Greece.

Some 150,000 persons were engaged in the manufacture of carpets in Asia Minor, of which it is stated that about 75 per cent are Greeks and Armenians, who are now in Greece. Raw materials, wool, cotton, dyes, etc., will be found in Greece of a better quality than in Turkey. The tanning of leather by chemical processes is also steadily gaining ground.

Factors Governing the Strength of Gear Teeth—Discussion

By G. W. Drake

I wish to call attention to an error in the article, "Factors Governing the Strength of Gear Teeth," by Douglas Hamilton, in Vol. 58, page 787, of the *American Machinist*.

Mr. Hamilton makes the statement that a steep helix angle reduces the cross section of the tooth on the normal plane, and hence weakens the tooth. He shows in Fig. 5 outlines of gear teeth on the normal and diametral planes to prove his statement.

The error in his statement and in the outlines shown will be readily seen when it is considered that it is almost universal custom to cut helical gears with regular standard spur gear cutters, in which case the cross section of the tooth on the normal plane will always be the same thickness regardless of the helix angle, and the thickness of the tooth on the diametral plane will vary with the helix angle. It would be possible, of course, to have the thickness of the tooth vary as Mr. Hamilton has shown, but it would not be practical as a general thing because it would require a special thickness of cutter for each helix angle.

I am aware of the fact that the Fellows Gear Shaper Co. advocates such a system and that the same company makes a similar statement and shows the same diagrams in its treatise, "Helical Gear." But it must be noted that the recommendation is for the adoption of only two helix angles, 15 deg. and 23 deg. in order to reduce the number of cutters required to as few as possible. The cutters are thinner than the standard cutters, one thickness for the 15-deg. angle and another thickness for the 23-deg. angle, and of such thickness that teeth cut by them will be of the same thickness on the diametral plane as regular spur gear teeth. Helical gears are by this system calculated in the same way as regular spur gears so far as pitch diameter and number of teeth are concerned.

The statement in question, however, should not be made as a general statement, but should be qualified as applying to the Fellows Gear Shaper Co.'s method of producing helical gears. When the helical angle is increased it becomes necessary to reduce the number of teeth if the pitch is to be maintained, or a finer pitch should be used if the number of teeth is to be maintained. For cases where the helical gears are to replace spur gears and it is desirable to maintain the same pitch diameters, number of teeth and center distance between shafts, the following method by E. J. Lees, of the Lees-Bradner Co., will be found very satisfactory. An example will illustrate it.

Example: To replace an 8 pitch spur gear with a helical gear of the same diameter and number of teeth, use a standard 10 pitch cutter (14½ deg. involute) with a helical angle of 36 deg., 52 min., and a 10 pitch depth. The resulting gear will then be the same on the diametral plane as an 8/10 stub tooth gear, except that the teeth are cut at an angle. If desired a 9 pitch cutter can be used with a helical angle of 27 deg., 16 min. To find the helical angle use the following formula:

Cosine of helical angle =

$$\frac{\text{Normal Pitch of Spur Gear.}}{\text{Normal Pitch of Helical Gear}}$$

Example: $\frac{8 \text{ pitch}}{9 \text{ pitch}} = 0.8888 =$ cosine 27 deg., 16 min.

The Methods and Principles of Frank B. Gilbreth, Inc.—V

By K. H. CONDIT
Editor, *American Machinist*

Route sheet to keep track of materials and parts—The instruction sheet—Duties of the foreman and inspector in keeping the production stream flowing smoothly

IN THE last article we discussed means of keeping the storeroom running in such shape that it could not be responsible for the failure of the man at the machine or the bench to get work materials as he needed them. Assuming that the storeroom is not at fault there may be other reasons why he does not get them. The move man, for instance, may not be functioning as intended.

In the small plant it is quite possible for the foreman to keep track of the movement of raw material and parts in process from machine to machine, but in larger plants some means of checking the movement of work is usually necessary. The Taylor route sheet illustrated in Fig. 17 was devised for this purpose and is used by the Gilbreths where it is applicable. In the form shown the columns at the right, which are used to check the work done on the part and its movement from machine, have not been filled out. A single line put in the proper column indicates the completion of the action designated at the top and enables the man in the routing office to keep track of what happens in the shop.

The columns at the left are used to record certain other facts about the job. Omitting the first two for the present we can see from the third column whether there is to be an instruction card telling what is to be done and whether the workman received it.

In the old days when operations were simpler and tools less complicated the all-round machinist needed only to be told what kind of results were wanted. He took care of the details himself and resented any further instructions. In small job and repair shops today the same conditions exist and the same methods may be used satisfactorily provided the right kind of machinist is on the job and handles the whole thing himself from start to finish.

A different method must be followed in the modern production shop where each man does only a very few of the many operations performed on a given piece. If he had to stop every time a new job came along to find out from the man who performed the previous operations just what he had done, and from the foreman or superintendent just what the piece was to be used for and what he was to do to it, and then tell the next man where he left off, progress would be slow. All sorts of instruction cards and forms have been worked out in various shops, some of them good, others

C M 10 32 R W - 1 M 10 32 R B 1 C

TIME FOR OPERATION	SCRAP	INST CARD	TOOL LIST	SKETCH			MOVE OPERATION FIRST INSP FINAL INSP
					Cylinder Base. Dr. 6633.1	40 WANTED WEIGHT	
					Iron Casting.		
					MATERIAL ORDERED		
					MATERIAL IN STORES		
551	193	1	1	1	1st. Bore and face. B 1 1 M 10 32 R B 1 C		
461	161	2	1		2nd. Bore for trunnion shaft. B 3.		
312	109	3	1	1	2 M 10 32 R B 1 C		
90	31	1	1	1	3rd. Layout. 3 M 10 32 R B 1 C		
					4th. Drill and tap. D 5. 4 M 10 32 R B 1 C	Do not post until MV6614.2B7C are	
					Send to L 5 and post 4RB2C.	at D 5.	
					To Assembly.		
TOTAL 1414	494						

FIG. 17—TAYLOR ROUTE SHEET

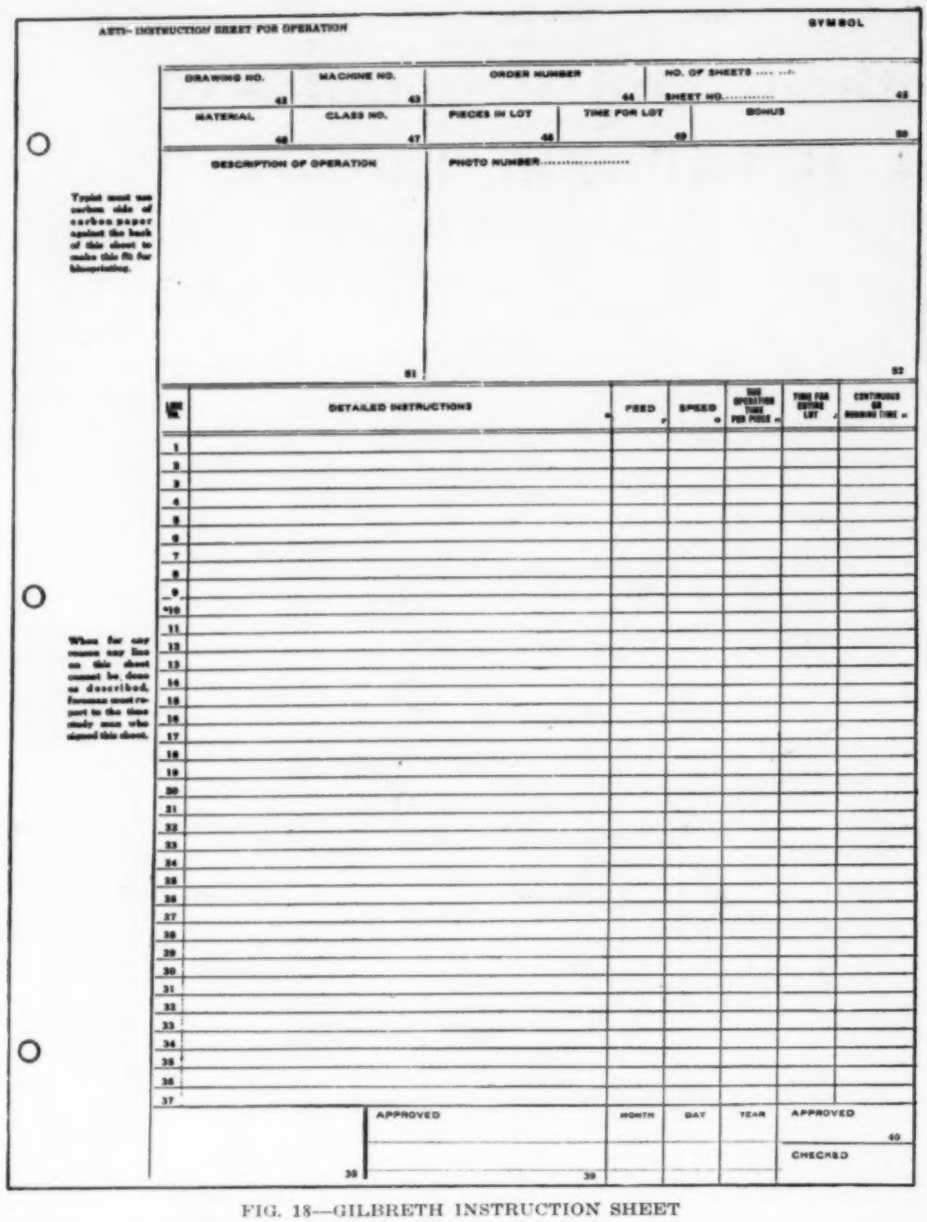


FIG. 18—GILBRETH INSTRUCTION SHEET

bad. One designed by the Gilbreths is shown in Fig. 18.

Enough was said about blank forms in the previous article to obviate the need of any particular comment on this except to say that wherever desirable a photograph of the piece is attached in space 52 to reduce the danger of mistakes due to ambiguity of the written description of the operations to be performed or to make more quickly understood what is wanted. It seems like a waste of words to say that the instructions should be complete and explicit, yet we have all seen many instructions that were hopelessly vague and depended to a large extent on the fact that the man to whom they were addressed had a good idea of what was needed from long experience with the job in question.

Unfortunately for the executive who is too lazy or too inaccurate to get out usable instructions, workmen do die and they do quit. And then a new man has to be broken in and it sometimes happens that nobody in the place knows all the details of the job done by the former holder of it and chaos is the result. Instructions, therefore, should be so explicit that they can be handed to a man who never saw the work before and will tell him so well what he is to do that he can start right in with no need for more than a question or two of his foreman. In fact, they should be so carefully thought out that there should be no need for revising them until the operations themselves are changed. Mr. Gilbreth sets a five-year limit on this. In other words, if no change in method is made in five years it is high time to find out why not.

One other point in connection with the instruction sheet is of importance. It has to do with the proper time of giving the sheet to the operator. If he gets it just as the old job is finished he naturally has to take time to study it to see what the new job calls for. It is much better practice to give it to him well before he wants it. As a matter of fact, it is sometimes advisable where the jobs are of short duration to give him several sheets ahead. Then as the machine works through a piece instead of standing idly by wondering what his friends are doing, it is much more interesting to hang the next sheet or two on the frame or hook over the machine and study it to see what is to be done next.

The same reasoning applies to the tool list for the next job. In addition the early receipt of the tool list may have this effect. The man who gets it may have had experience on similar work and may remember the tools he used to get the best results. When he gets the list and finds the tools are not the best ones for the job he can call his foreman and tell him about it. In this way the workman checks up on the planning department. If he got the list just as he needed the tools he might very reasonably decide that it would be easier and quicker to get the tools called for than to take the trouble to upset the system enough to get the ones he knows are better for the job. He might well consider that it was not his affair.

It seldom happens that many errors are caught on the planning department. For one reason, their pride would suffer seriously if there were very many. For another, the man who was making such errors would soon be transferred to some position better suited to his ability.

Getting back now to the matter of keeping the workman supplied with work, it is the Gilbreth rule that at least one day's supply should be at the machine. The rule applies within reasonable limitations even where conveying systems are used. Conveyors have accidents

occasionally and something may happen to the supply of parts before it reaches the conveyor. The man at the machine can then draw on his reserve supply and keep from losing his bonus through no fault of his own.

There are various ways of keeping track of material supplies at the machines but the one best way is to make the foreman also responsible that the men under him have a day's supply ahead all the time. If the foreman has to go to each machine every morning and every night to assure himself that the required supply of material is on hand it is a fairly safe bet that he gets better acquainted with his men than if he does his work from an office chair. At the same time he can keep an eye on conditions at and around the machines and will hear of difficulties as the men get to know him. Many times he will get word of trouble symptoms soon enough to take steps to prevent the trouble from developing. A man will tell him of a slipping belt or an ominous squeak as he passes where he would put off making a special trip to the foreman's office to report the trouble until it was really serious.

According to the Gilbreth ideas the foreman has three other jobs beside seeing that his men get material to work with. The first of these is to teach, the second, to see that conditions are right at each man's place and the third, to investigate at once the failure of any man to meet his task or time program requirements. In larger plants or in smaller ones where one foreman has a large number of men under him, some of his efforts may be supplemented by his inspector. The duties of the inspector include not only inspection for both quality and quantity but also for standard conditions of working as called for on instruction sheet and tool list. If either falls below standard he must find out why, which necessitates inspection of conditions at the work place. The foreman and the inspector independently are responsible that conditions are in accordance with those under which the task or time program was set and therefore every man in the department shall be able to make his task. Between them they should catch any deviation from standard practice before it becomes serious and keep everything running smoothly.

Who Was to Blame for This Injustice?—Discussion

BY F. P. TERRY

The contribution under the above heading, page 555, Vol. 58, of *American Machinist*, by Alvaro De Palante, was read by me with interest, partly because I had a very similar experience some time ago. I was the superintendent, and the "Rob Brown" of a foreman had to go.

After carefully reading Mr. De Palante's description of the case, I fail to see any injustice, but rather an error of judgment, both by foreman and superintendent. In the first place Brown committed a grave error in judgment, and must be considered mostly to blame for accepting a job which he was not capable of filling, no matter how pressing the invitation. We must, of course, give full credit to the fact that he never presumed he could do it, and it was not of his own seeking, but we must also remember that the superintendent was actuated by the best of motives, and the resultant failure would cause him bitter reflections. He had promised every assistance possible, and no doubt had the foreman known how to take advantage of this, he would have been still in his position, or a better one, and to find out that useless work has been sent out and to say or do nothing for a week, puts this foreman out of the picture altogether.

During the past twenty years I have fathered many young men along the thorny path that every foreman must tread before he reaches comfortable traveling, and the ones who have been most successful took full advantage of the help I had offered, even to obtaining my judgment on minor details and tittle-tattle, and, while not encouraging this sort of thing, I have always considered that the foreman has to deal with them and the sooner he learns how the better. In no case should a foreman do as Brown did, as by so doing he also commits the superintendent and puts both in a false position. Some may think that at least Brown should have been offered his old position again, but any superintendent knows this is a difficult proposition. Many reasons could be given against it, but the feelings of the foreman who has failed and the life he would have with his fellow workers are sufficient to condemn it.

In my own case, my failure adopted an attitude of hiding everything he possibly could from me, spoiled work in particular. Although more often than not he was not to blame for the errors, his unholy dread of getting others into trouble brought about his downfall. He had a favorite habit of slipping back bad castings to the foundry foreman for replacement, without the foundry superintendent or myself being informed, and, when after many fatherly warnings on my part he caused me to miss a very important shipment, he had to go. Had I been informed at the proper time nothing would have happened, and why he did not know this and act accordingly is a mystery I can never explain. Some men seem born to make trouble for themselves and everyone else about them. It may be fate, and if Mr. De Palante puts Brown's troubles down to fate he will not be far wrong, as he certainly cannot blame the superintendent beyond the fact that he over-rated Brown's abilities, a simple error of judgment, or in other words, an experiment that failed, from which both parties will certainly benefit in the end.

Tests All-Metal Plane

The Army Air Service is testing at McCook Field near Dayton, an all-metal airplane designated as the CO-1, the first of the kind designed by the army and the latest type of airplane brought out by its engineering division. It has already made a maiden flight and full performance trials are under way.

The plane may be left in the open indefinitely, making the use of hangars unnecessary. It has the further advantage that while the usual fabric wing and fuselage has to be removed once a year, in the case of the all-metal plane the duralumin covering is a permanent part of its structure and does not require replacement.

Both wings of the new planes are covered with ocrrugated duralumin and the structure proper is heat-treated steel and duralumin. The plane weighs 3,000 lb. empty and 4,750 lb. when fully loaded. Unlike most metal-covered planes, the CO-1 is not overweight and air experts have said that it can carry loads greatly in excess of the specified design load of 1,750 pounds.

It is powered by the Standard Liberty-twelve engine and has a gasoline capacity of 125 gallons. Glass windshields are provided at the sides of the pilot's cockpit.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Novel Gantry Plate-Drilling Machine

BY FRANK C. HUDSON

During the late war, Seattle, Wash., was a very active shipbuilding center, and all the available machining capacity was pressed into service. Among the shops engaged in building marine boilers was that of the Puget Sound Machinery Co., now known as the Garret & Shipman Co. The work involved the drilling of large numbers of boiler plates ranging up to 1⅞ in. in thickness.

Machine tools of all kinds were scarce and difficult to obtain, so, in order to facilitate the work, a special

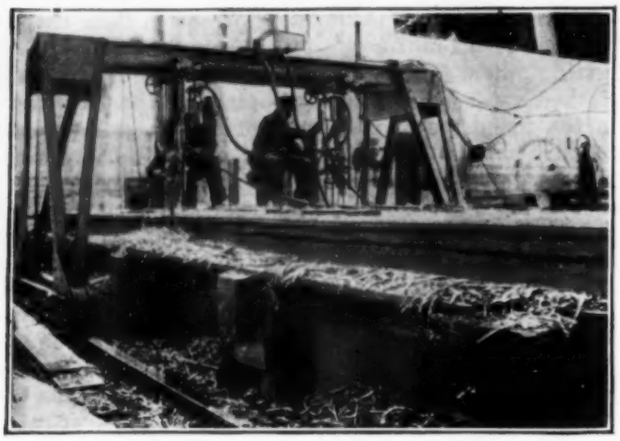


FIG. 1—A LARGE GANTRY PLATE-DRILLING MACHINE

type of drilling machine was designed and built, as shown in Fig. 1. As will be seen, this machine consists primarily of a table on which the plates to be drilled are supported, and a "gantry," spanning the table and running on a substantial track on each side. The cross member of the gantry is a pair of substantial I-beams on which are mounted trolleys, which are shown more in detail in Fig. 2.

Each of these trolleys carries a specially designed support for a heavy Van Dorn electric-drill, known as the C-2,900, and wound for direct current. The upper part of the support is a cylinder which provides hydraulic feed for the drills, each drill being entirely independent in every way.

Although both views show only two drilling heads in operation, four of these heads were used simultaneously during the rush period, when a maximum output was necessary. These comparatively small machines handled 1⅛ in. drills through three thicknesses of ⅞-in. boiler plates, or a total of 4⅛ in. of metal drilled. Using high-speed drills, the average time per hole was 8 min., including all shifting and changing necessary, not only of the drilling heads on the supporting beam but of the gantry along the rails as well.

The general dimensions of this machine can be readily estimated from the size of the men, and it is well to remember that the sheets on a large marine boiler run up into considerable length. The table is over 50 ft. long, and the track enough longer so that the

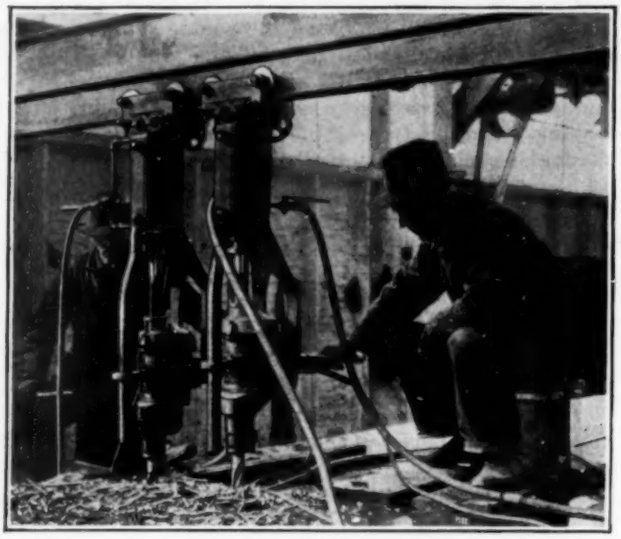


FIG. 2—TWO OF THE DRILLING HEADS AT WORK

extreme end of the plate can be reached by the drills without difficulty.

A little study of Fig. 2 will show what a simple device is sufficient for holding the drill head from turning, and also for guiding it as it is fed down by the hydraulic cylinder above. It will also be seen that each drilling head is provided with a horizontal adjusting mechanism, so that it is not necessary to bring the gantry itself to the exact position required. The location of the drills across the plate is easily secured by moving the trolleys on the lower flanges of the I-beams. This machine was extremely economical and efficient method in handling the work, and is still being used for a large variety of plate drilling.

Regrinding, Reboring or Reaming Cylinders—Discussion

BY ROBERT TAIT

Under the above title on page 744, Vol. 58, of the *American Machinist*, M. I. Seiler has an interesting article concerning the relative merits of reaming, boring and grinding the cylinders of automotive engines. He still hugs the delusion that grinding will charge the cylinder surface with particles of abrasive from the wheel, causing rapid wear when the motor is put into service. I have before me a "Machine Shop Library" published by the McGraw-Hill Book Co. in 1912, and in the volume on grinding, this matter is taken up and disposed of

quite thoroughly, indicating that this question was under consideration over 11 years ago.

It has been my privilege to have some experience in boring, reaming and grinding cylinders. Boring, if done carefully, on a good machine will produce a creditable job. Reaming cannot be depended upon at all, for several reasons.

A very large per cent of the pleasure car cylinders which are refinished are from cars in the low or medium price class and a large proportion of such cylinders are out of square with the crankshaft. Reaming, no matter how carefully done, will not correct this error, and it is a most serious one.

After a cylinder has been scored by a piston, no reamer made will survive the ordeal of scraping off the hard spots which scoring invariably causes and produce a round straight hole without being resharpened. As the vast majority of those who make a practice of reaming cylinders have no means of grinding the reamers, faulty work is bound to result.

If boring or reaming is the proper method of finishing cylinder bores, why do the makers of every really high grade car in this country finish them by grinding?

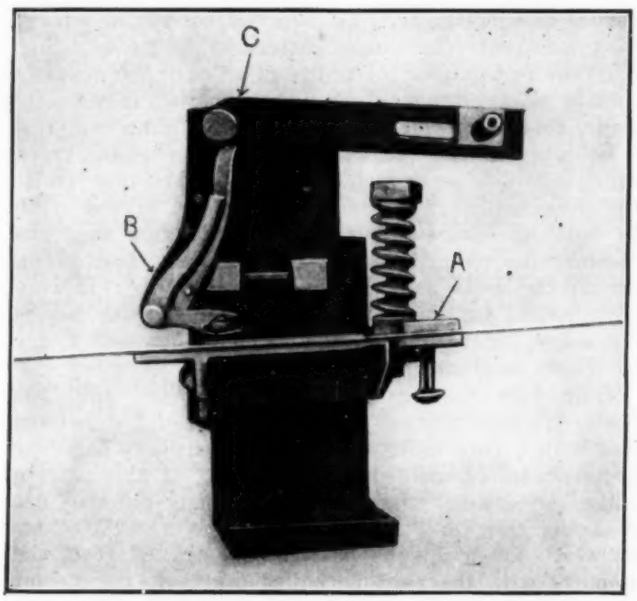
Feeding Device for Punch Press

By Clifford H. French

Having a lot of washers to punch, and only being able to get about 1,000 an hour by hand feeding, the American Machine Co., of Pueblo, Colo., built the feeding device shown. It is attached to the punch press table beside the die and feeds the strip of metal with every stroke of the press.

There is a friction plate at *A* to prevent "throwing," while the feed is secured by the latch *B*, pivoted on the arm *C*. This arm is operated from the slide of the press, the stroke being adjustable by moving the connection in the slot. The feeding latch drops into the punched holes, so the device has to be located after the first washer is punched out. The first of the strip is punched by hand, then the feed takes hold.

This device increased the output from 1,000 to 6,000 washers per hour.



SMALL AUTOMATIC FEEDING DEVICE

Device for Testing the Tooth Faces of Hobs and Gear Cutters

By A. W. Freeman

This device consists of a steel angle with a V cut in the bottom of its base and a slot milled in the upright portion, wide enough for a free sliding fit for the Kotch indicator *A*, as shown in the accompanying

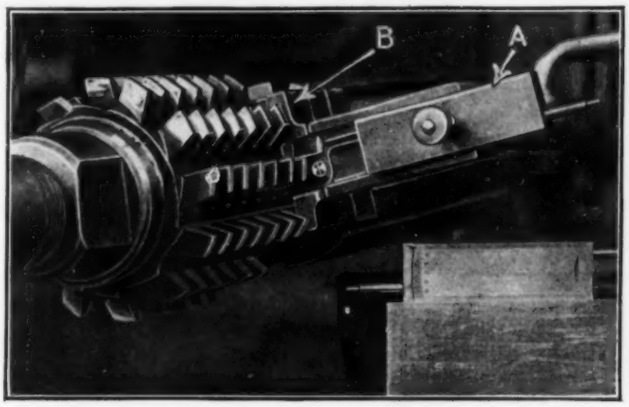


FIG. 1—HOW THE HOB TESTING-DEVICE IS USED

illustrations. At the lower end of the slot is a tooth stop *B*, the face of which is radial to a circle whose periphery touches both sides of the V in the base. To use the device, it is placed with the V resting on the arbor at the end of the hob, with the tooth stop *B* resting against one tooth of the hob and covering about one-half of the tooth face. The Kotch indicator is then placed in the slot until the indicator finger connects with the face of the tooth alongside the tooth stop.

If the tooth face is correct the indicator will register

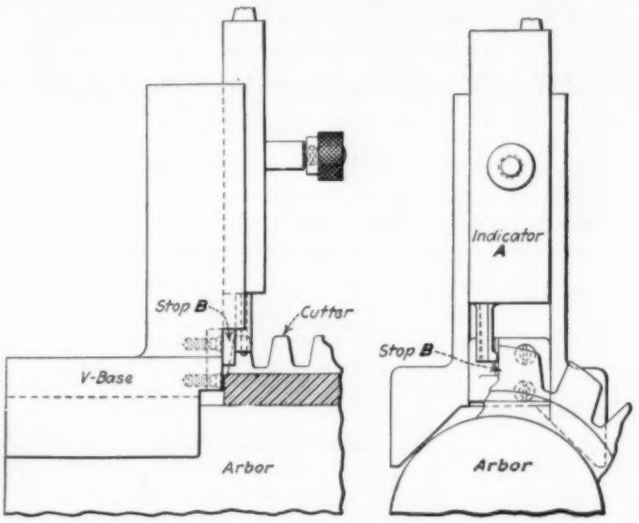


FIG. 2—DETAILS OF HOB TESTING-DEVICE

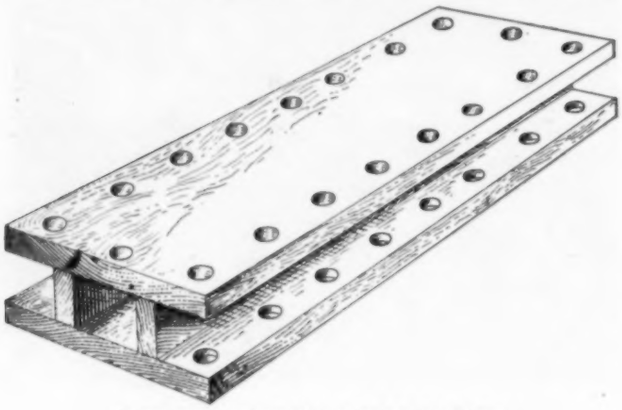
zero without variation when sliding it from the top to the bottom of the tooth face. The indicator registers 0.005 in. either side of zero, giving a total reading of 0.010 in. The device will check hobs of from six to twelve pitch and will be found a time saver for rapid checking, as it is not necessary to remove the hob from either the machine or arbor in order to check it. Bushings may be placed on the arbor for the V base to rest on for checking hobs of larger diameter. Fig. 1 shows the device in use and Fig. 2 shows it in detail.

Rack for Motor Valves

BY I. B. RICH

Too many garages neglect to take proper care of the parts of the motor as it is disassembled. This is particularly true of the valves, which are in many cases strewn around promiscuously either on the running board or some other equally convenient place.

In the automobile repair department of the Oppor-



RACK FOR HOLDING MOTOR VALVES

tunity School in Denver, Col., the instructor, Victor England, uses a rack as shown in the accompanying sketch. This, as can be seen, is very easily made from four pieces of board, the two central pieces simply holding the main boards the correct distance apart.

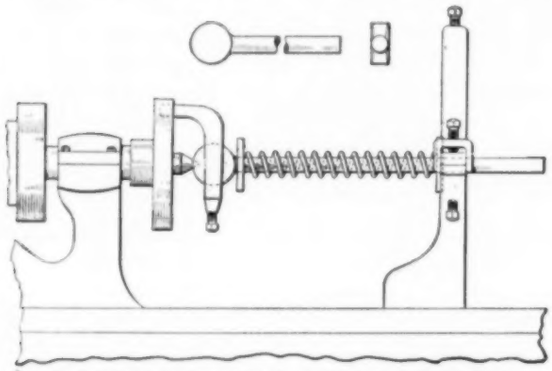
There are eight holes sufficiently large to hold any size valve stem. The holes go clear through the upper board, but only half way through the lower board, so that the ends of the valve stems may be always protected. The rack is also provided with a hole at each end, so that it can be hung on a rail when out of use.

Holding Work Against the Live Center

BY H. H. KNABE

Having a number of forged pieces to be centered, I adopted the method here described.

The ends with the heads were centered first by chucking the small ends in a 3-jawed chuck and back resting



HOLDING WORK AGAINST THE LIVE CENTER

the other ends close to the head, but the small ends could not be done by chucking the heads because the heads, being rough forgings, were not alike and truing each one up would have been too much trouble.

To use the headstock center with the regular holdback strap would have been too slow, so I devised the expedient illustrated by the accompanying sketch. After putting the driving dog on the work I put on two washers with a fairly stiff coil spring between them. One washer rested against the head of the piece and the other against the jaws of the steadyrest, the spring having plenty of compression to hold the work firmly against the live center.

Two Ways of Making a Core—Discussion

BY M. E. DUGGAN

Sometime ago F. C. Edwards, residing in England, expressed great surprise after reading the article by the writer under the above title on page 735, Vol. 57, of the *American Machinist*. In fact Mr. Edwards came very near furnishing work for the undertaker when he came to the part in this article where I made mention that "there is no standard to be followed in the construction of patterns and core boxes." There is nothing in this statement that should bring about this upset condition in my brother pattern maker over in England.

In the sketch herewith there is shown a cast sheave wheel for a chain. How would you make the pattern for this wheel? Split through the middle as shown, the whole pattern to be molded in green sand? Sure. Nine out of ten pattern makers would make it in the same way. That's the way I made my pattern, pre-

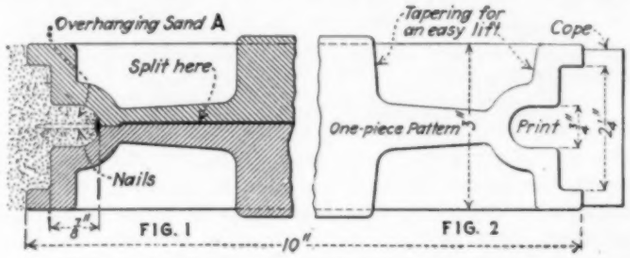


FIG. 1—SPLIT PATTERNS TO BE MOLDED IN GREEN SAND.
FIG. 2—SOLID PATTERN ARRANGED FOR A DRY SAND CORE

determining a green sand molding job. When the molder saw my pattern he said, "Mike, you're wrong. Why construct your sheave pattern in such a way that will require thirty or thirty-five minutes of the molder's time in making the mold when the same job, if correctly made, could be molded in ten or twelve minutes?"

In other words the overhanging ring *A* of green sand is not wide enough to support itself nor resist the pressure of the rising molten metal in the mold. In order to secure this ring of overhanging sand the molder was obliged to use nails spaced about ½ in. around the inside as shown in Fig. 1. If this ring were 1 in. or 1¼ in. thick, the use of nails would not be necessary. For this job the molder suggested a dry sand core as shown in Fig. 2.

Only four castings were wanted. Why split the pattern? Splitting only tends to weaken the pattern and with a core, splitting is unnecessary as the whole pattern can be molded in the drag. If the pattern maker were asked the reason why many patterns are made as they are, he could not give a satisfactory answer. When a split pattern is returned from the foundry with the sections nailed together, the molder must have had a reason for doing the nailing.

Inexpensive Tools for an Odd-Shaped Piece

BY DONALD A. HAMPSON

A cutting tool that has to be machined from the rough in quantities varying from a score to a hundred, is shown in Fig. 1. It is one of those jobs that cannot be put on a production basis, yet are supposed to run through at a profit to the shop and a reasonable cost to the customer. Making up a year's quantity at one time is out of the question for the customer will send in only such pieces as are needed, when they are needed.

Under such circumstances no great outlay for tools is justified, though tools there must be if the work is to be done at a price that is not prohibitive. Figs. 2 and 3 show two fixtures that were made at a nominal cost and that answer very satisfactorily for the quantities named.

The blanks are received just as forged. They are made of 0.90 carbon, ½-in. round steel. They are first bent (hot) and then shaped to form under dies in a hammer.

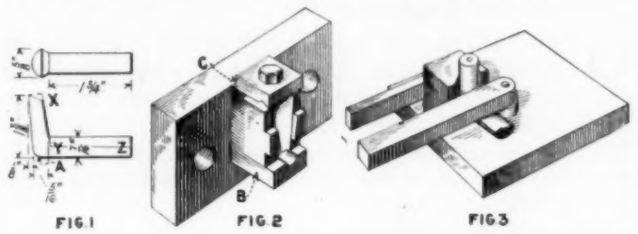


FIG. 1—THE TOOL TO BE MACHINED. FIG. 2—FIXTURE FOR DRIVING THE WORK FOR TURNING. FIG. 3—HOLDING THE WORK FOR CENTERING

The dies are made with opposing faces along the line *X Y Z*, which leaves very little cleaning up to do in the finishing operation. Finishing consists of turning the shanks to size, removal of fire scale from the blades, and shaping the points.

The points as forged fill out the corner at *X*, from which material has to be ground to form a cutting edge. Turning the shank is the part of the work that was found most difficult because of the angle and flare of the blade, which made chucking commercially impossible, and the fact that the corner at *A* does not usually fill up enough to get in a center readily—a small center being permissible though under protest, for hardening reasons.

The actual turning time was 3 min. from piece to piece. The forgings were held between the tailstock center and the casting shown in Fig. 2, which served as a driver, socket, and clamp. A projecting part of the casting is hollowed out to fit the half round back of the blade and side lugs are used to do the driving. A steel piece *B* is screwed to one end of the projection and has a cut-out of ¼-in. radius so placed as to bring the blank on the center line of the lathe. The cap *C* is used to clamp the blade against its seat.

With this arrangement, the pieces are located in the lathe without delay and without requiring skilled labor to center them. They are positively held and driven, despite the rounded section of constantly changing size, and there is ample clearance for the turning tool. Two bolts are used to attach the fixture to the face plate of the lathe.

To put the center hole in the free end of the shank, the fixture shown in Fig. 3 was made, and in use is held on the drilling machine table by two C-clamps. The simple method of holding the forgings for center drilling is apparent. No center punching or centering is required.

Surfacing Large Base Plates on a Small Planer

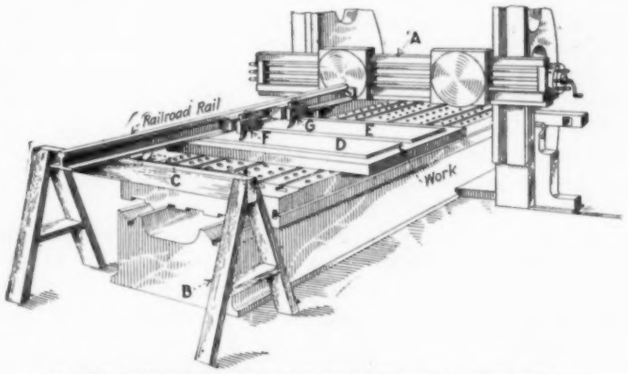
BY FRANK C. HUDSON

There is always something interesting about handling a job that is too big for any machine in the shop—in doing the job that can't be done, and there are probably more such jobs today in the shops in the far West than anywhere else.

Here is an interesting planer job I found in the shop of the Helser Machine Works Co., Portland, Ore. The job itself had been done sometime before but there were enough of the parts in existence to rebuild it on paper, and it's a different solution of the problem than we usually find.

The job was to place a number of base plates, for ship-yard machines I believe, the plates being about a foot wider than the planer would pass between the housings. They were also too long to plane by the usual extension tool post method, so the foreman got a railway rail about 12 ft. long and fastened one end to the saddle on the cross-rail as at *A*, after removing the clapper box and tool clamps. The outer end of the rail was supported on a substantial wooden horse as at *B*, which was carefully lined up so as to hold the rail level and finally fastened to the floor. A feed screw was provided at *C* by which the end of the rail could be moved along the top of the horse.

The surface of the work was not continuous but consisted of two raised portions as *D* and *E*, so in order to save time two tools were fastened to the long rail, as at *F* and *G*, and the table travel cut in half. The work was so located on the planer bed that there was plenty of clearance in front of the housings at the end of the stroke. The cross feeds at both ends



HOW THE PLANER WAS RIGGED FOR THE JOB

of the rail were operated by hand and were entirely indpendent of each other as it wasn't especially important that the rail remain square with the cross-rail. In fact it probably never was square, but it held the tools and a goodly number of the plates were planed in fairly good time.

The method described isn't exactly the one we would choose to plane up surface plates but it was plenty good enough for the work done, and the method may help others who have work to do that is larger than the machines were originally intended for.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

July 5, 1923

The American Machinist Starts its Fifty-ninth Volume

WITH this issue the *American Machinist* commences its fifty-ninth volume. Established in 1877, the paper has forged steadily ahead, a mirror of the progress in the mechanical arts and a leader in the thought of the metal-working industry. During its nearly forty-six years, the *American Machinist* has not changed its name nor has it absorbed any other papers or combined with any.

The present editorial staff consists of Kenneth H. Condit and Fred H. Colvin, editors; A. L. DeLeeuw, consulting editor; L. C. Morrow, managing editor, and S. A. Hand, Ethan Viall, Ellsworth Sheldon, Howard Campbell and C. J. Priebe, associate editors.

The Ocean Speed Record Returns to America

THE SPEED records made by the Leviathan on her trial trip are very gratifying for several reasons. But once since the days of our famous old clipper ships have speed records for big ships been held by boats flying the American flag. When the Leviathan gets broken in on the transatlantic run we may expect record trips that will appeal not only to our self-esteem and sporting instincts but will also attract business to American passenger ships.

The pride of our merchant marine was built by Germans in a German shipyard, but she was also pretty thoroughly wrecked mechanically by her German crew. The achievement of repairing the damage by applying American shop methods and the final refitting in an American shipyard at a total expense not far short of ten million dollars give us good cause to consider her an American ship and to be proud of our shops, their men and their workmanship.

As to the much-discussed trial trip the opposition seems to have been entirely of a partisan political nature and its motives beneath contempt. We have heard that one of the noisiest objectors was unable to secure accommodations for his wife on the trip.

We were not fortunate enough to secure an invitation to go on the five-day cruise but we have at least had the pleasure each day since its conclusion of looking out of our window at the ship herself as she lies, a picture of grace and potential power, at her pier.

First-hand impressions of the trip have come to us through one of our colleagues, Fred. R. Low, editor of *Power*, who was one of the lucky guests. Mr. Low says, "No country can be great with a world's greatness without a merchant marine. No country can maintain a great merchant marine without passenger traffic. To wrest the passenger traffic from lines which have a prestige founded upon years of successful operation, a clientele attached by habitude, vogue and pleasant associations it is necessary that one offers something superlatively better. Hence the Leviathan.

"It was necessary before putting such a ship into commission to give her a thorough trial under seagoing conditions and those in charge considered it, if not as essential, at least as desirable that the personnel of the boat, stewards, culinary department, etc., should have a chance to accustom themselves to the boat and organize their service under the conditions of an actual passage. Accordingly some 400 guests were invited to supply the passenger list. It was a wise provision, for notwithstanding the service as a whole went very smoothly, a number of little oversights developed under the conditions of actual use and opportunity was afforded for daily fire drills, boat drills and the handling of signals and passengers under such emergencies."

The Salesman vs. the Engineer

ONE of the points brought out in the discussion of four-wheel brakes at the S.A.E. convention was the danger of engineers being stampeded by the sales department into putting out new devices before they had been thoroughly tested. This situation applies to so many businesses that it is worth considering from several different angles.

The increasing numbers of cars on the roads make better braking equipment a necessity, and when we know that four-wheel brakes have been in use by foreign builders for a number of years, there seems to be no reason why they cannot be adapted to American cars. The very fact that they have not been seriously considered here except by a few builders, is on the face of it, not altogether creditable to the progressiveness of our engineers. Their alibi would probably be that there have been so many other things demanded by the sales department that there has been no time for four-wheel brakes.

There can be no doubt as to the desirability of the four-wheel brake and it is undoubtedly coming in this country, as well as abroad. The problem is however, not so simple as it seems, for it involves new stresses on the front axle, more unsprung weight and numerous other problems. For a front wheel brake may be a source of danger instead of safety unless all the effects of its use are carefully considered.

The broad question, however, is how far the sales department should go in forcing the adoption of new devices. Neither the engineer nor the sales department can be trusted to have final decision in these matters. That is where the real manager comes in. But the manager who succeeds in the long run is the one who can carefully weigh the arguments on both sides and decide which is best for the company and its customers. In too many cases the sales department receives undue consideration, and while the immediate cash returns come from this source, reputation, or its lack, is much more important in the long run. If the engineer is not competent, get one that is. But it is a great mistake to consider the engineering department, as seems to be the case in too many instances, as a necessary evil, to be tolerated, but of little account.

Shop Equipment News

Automatic Machine Co. Frog and Switch Grinding Machine

The machine here illustrated and described was designed and built by the Automatic Machine Co., 113 E. Washington Ave., Bridgeport, Conn., for the purpose of machining frogs, cross-overs and other elements of railroad track work that are made up of, or surfaced with, manganese steel castings and cannot, therefore, be worked by any tool other than a grinding wheel. It is distinctly a manufacturing machine, intended to be permanently erected in the shop of the builders of this class of material, and is not in any sense a portable track grinding or resurfacing machine to be used upon track already laid.

The machine when ready for service runs upon a permanent narrow-gage track that is supported upon concrete pedestals of sufficient height to allow the necessary clearance under the grinding wheels. For the purpose of holding the work, a bed, or floor plate, also set in concrete, is placed adjacent to the supporting track and under the grinding wheels.

The entire machine is traversed by power along the track, the length of traverse being limited only by the length of track. Power for the traversing movement is supplied by a 15 hp. electric motor mounted on top of the machine and is transmitted to the driving mechanism by means of open and crossed belts.

This movement is analogous to that of a traversing head planer and it may be set to any desired length within the limits of the track. It is controlled by the lever shown at the extreme left of the machine in Fig. 1, which is the operating position. The disk immediately behind the control lever rotates slowly with the traverse of the machine, and the amplitude of the movement is determined by the setting of the adjustable dogs in the annular T-slot in the face of the disk.

The grinding heads, of which there are two, have a transverse movement along the box-sectioned beam projecting at right angle to the body of the machine, which beam serves the same purpose as the cross-rail of a planer. The heads are separate and capable of movement along the beam independently or in unison. Independent vertical adjustment is also provided. The heads may be moved quickly by hand for positioning, or by power for the feeding movement.

The machine swings a pair of grinding wheels 14 in. in diameter by 3 in. face, driven by independent 10 hp. electric motors mounted directly upon the heads. Power is transmitted to the wheel spindles by belts.

In Fig. 2 the body of the machine is shown inverted, and from this cut an idea may be gained as to the method of transmitting power to the traversing movement and also of

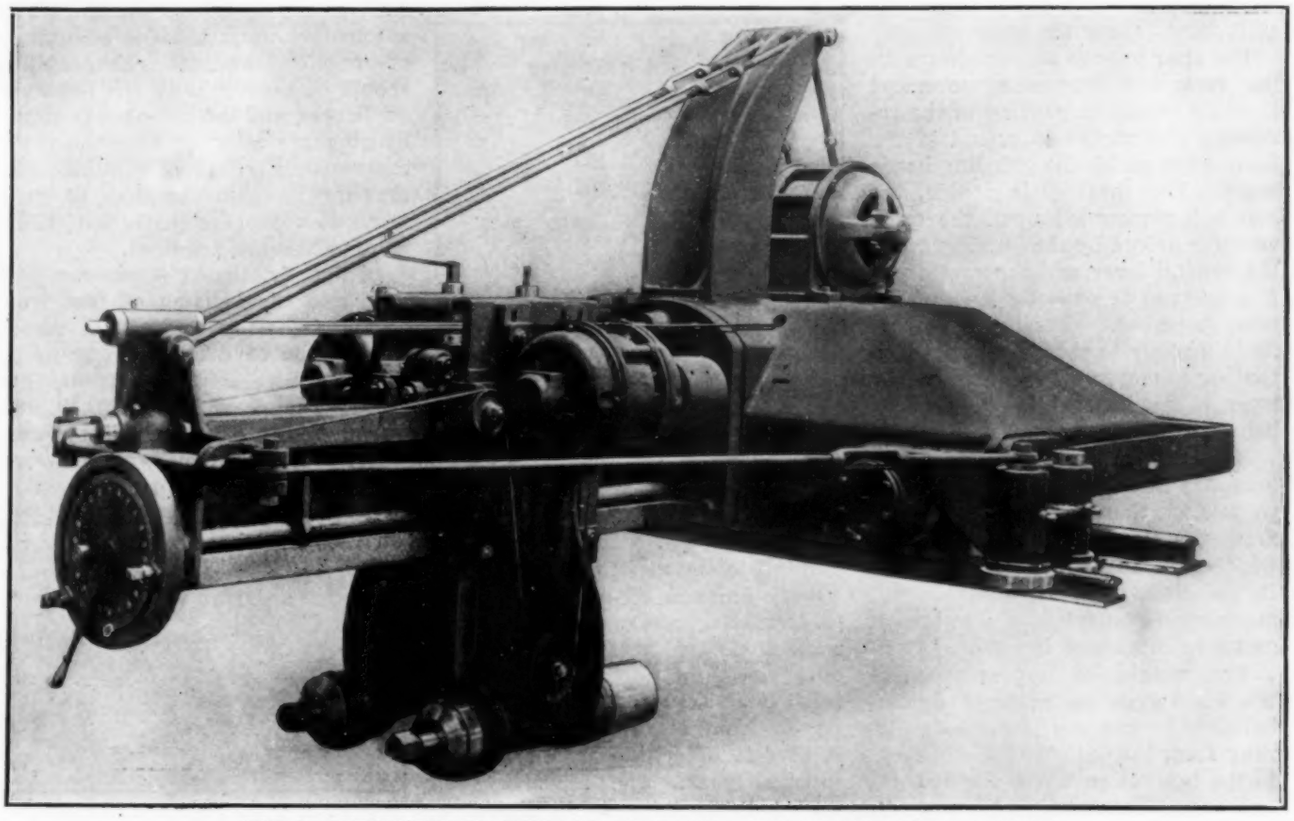


FIG. 1—AUTOMATIC MACHINE CO. FROG AND SWITCH GRINDING MACHINE

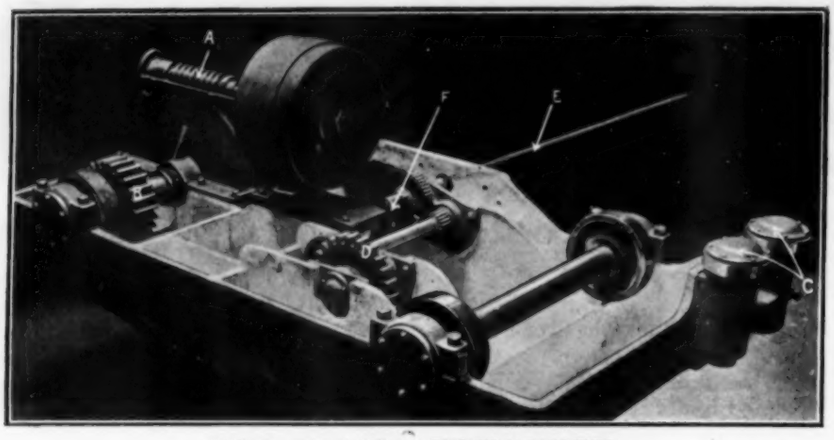


FIG. 2—BODY OF MACHINE INVERTED

the mechanism for controlling the amplitude of the movement. The belts from the motor drive the nest of pulleys in opposite directions, the same as in any shifting belt planer. The two outer pulleys are idlers while the middle one is keyed to the shaft of the worm *A*, which meshes with a corresponding worm-wheel upon the drive shaft.

The weight of the machine is borne by four track wheels, running free upon roller bearings, and power is applied to the traverse through the spur gear *B*, meshing with a rack that is bracketed to one of the track rails. Guide rolls *C*, of which there is a pair at each end of the machine, serve to keep the latter in alignment as it moves along the track.

The spur gear *D* also meshes with the rack and transmits movement through reduction gearing to the reversing dial at the outer end of the beam upon which the grinding heads move. The shaft *E* is double, the dial being mounted upon the quill, which is driven by the gearing, while the control lever and the crank-arm *F* are keyed to opposite ends of the inner member. Crank-arm *F* connects directly to the shipper plate so that any movement of the control lever is transmitted to the shifting belts.

All rotating parts turn upon ball or roller bearings that are enclosed to protect them as far as possible from the cloud of abrasive dust in which the machine must work; for in the class of work to which this machine is adapted no water or grinding compound is used.

The weight of the overhanging beam and grinding heads is counterbalanced by means of truss rods running from the outer end of the beam to the bracket on top of the machine and thence to a rail on the opposite side from which suitable counter weights are suspended, so that the machine is in stable equilibrium. The weight of the machine exclusive of track and bed or floor-plate is 20,000 pounds.

Clark Flexible Coupling

A flexible coupling for power transmission shafts that combines both strength, durability, flexibility and adaptability to a wide range of work has recently been placed on the market by Charles H. Clark, 60 Grand St., New York, N. Y. The main feature of the coupling, which is shown assembled in Fig. 1, is its simplicity. The parts can be seen

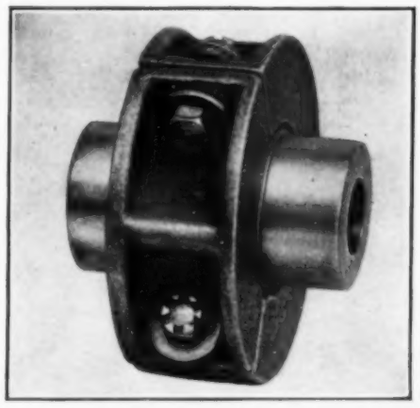


FIG. 1—CLARK FLEXIBLE COUPLING

in the view of the disassembled coupling in Fig. 2.

The hubs are fitted to the shafts by keys in the usual manner. Each hub is finished all over and has a triangular shaped face to form three projections or teeth. A housing made in three pieces incloses the teeth and serves to transmit the power from one hub to the other somewhat after the manner of an internal gear. The joint between each housing is made by means of a bolt fitted with a locknut and carrying leather washers at each end to provide flexibility. A dowel pin is also provided at each joint.

The degree of flexibility depends to some extent upon the tightness with which the bolts are fitted, although the shocks are absorbed by the ability of the housing to expand. Further flexibility is given by the insertion of a piece of steel-faced automobile brake lining in each housing to cover the acting portion of the tooth. The lining takes the shock and makes the action of the coupling noiseless.

End play is permitted by making the inside of the coupling somewhat wider than the width of the two teeth. Both angular and parallel misalignments of the center lines of the shafts are permissible. The coupling is intended to operate under practically any conditions of speed or of duty, to transmit power up to the capacity of the shafting. The teeth surfaces are lubricated by grease, which the action of centrifugal force tends to throw to the tops of them. The housing is dust and grease proof, because of the packing which is placed at each joint of the housing and at each side of it next to the hubs.

The coupling can be furnished in practically all sizes required for power transmission. For small work, such as motor-driven machines and automotive purposes, the advantage of simplicity and interchangeability should be noted. Both the hubs are duplicates, and the three parts of the housing are alike, so that the parts can very easily be kept in stock. The coupling is also adapted to very heavy drives where shafts, say, 12 in. in diameter are required.

Ordinarily, the hubs are made of steel and the housing of cast iron, although the material can be varied to suit the conditions. A coupling having a bore 1 in. in diameter has an outside diameter of 5 in., an overall length of 3½ in. without considering the end play, which is ¼ in., and the weight is 6 pounds.

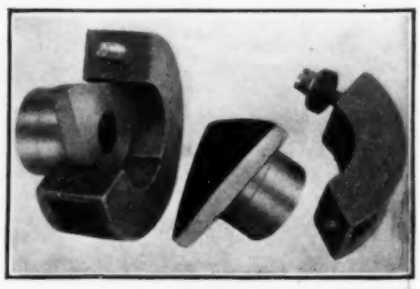


FIG. 2—CLARK COUPLING DISASSEMBLED

Kingsbury Semi-Automatic Sensitive Drilling Machines

The automatic sensitive horizontal-spindle drilling machine No. 8 made by the Kingsbury Manufacturing Co., Keene, N. H., was described on page 666, Vol. 57 of the *American Machinist*. This automatic unit has been mounted on stands, in conjunction with other apparatus, to form high-speed machines for special purposes. The machine shown in Fig. 1 carries two opposed automatic drilling heads to form a semi-automatic unit. The heads are fitted with automatic feeding devices by which the rate of feed is retarded or increased to suit the resistance encountered by the drill. Thus, the operator need only handle work, and not feed the spindles.

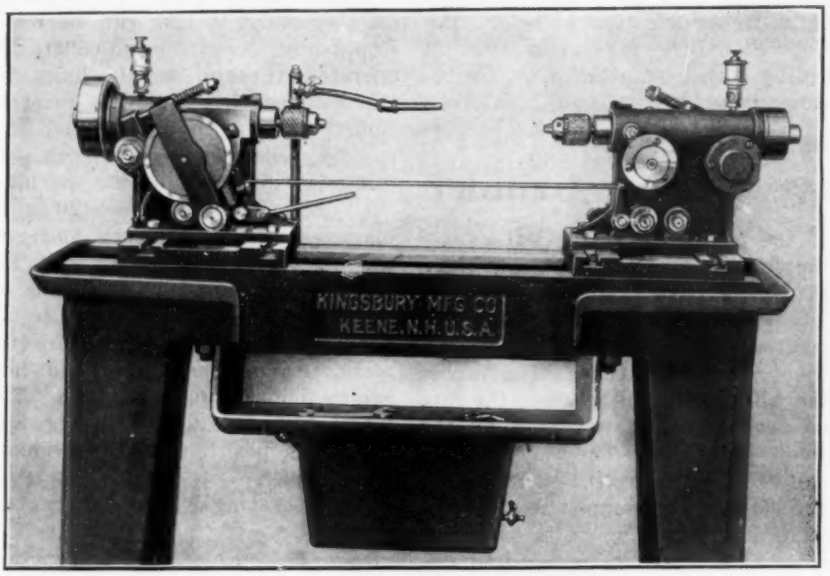


FIG. 1—KINGSBURY OPPOSED-SPINDLE SENSITIVE DRILLING MACHINE

The arrangement illustrated can be employed for drilling two holes simultaneously, or for drilling and reaming through holes. For the latter work, the drill head at the left is used for drilling and the one at the right for reaming. After the work is clamped in the fixture, the operator presses the trip lever. When the drill spindle reaches the forward end of its stroke, the opposed spindle is automatically tripped, and the reamer enters the work as the drill is withdrawn. Due to the fact that the operator can often handle more than one pair of units, the stand can be furnished with as many as five pairs of spindles.

The capacity of the unit equipped with No. 8 drill heads is $\frac{1}{4}$ in., while it is $\frac{3}{8}$ in. for the No. $8\frac{1}{2}$ head when drilling steel and $\frac{1}{2}$ in. when drilling brass. The standard stroke is 1 in., with a spindle adjustment of 2 in. The maximum distance between the chucks in the open position is 18 in. The stand is $43\frac{1}{2}$ x 15 x 36 in. high, and weighs about 500 lb. when equipped with the oil tank. A countershaft can be provided.

In Fig. 2 is shown a multiple-spindle type of machine for drilling small holes on a production basis. Here again the feed is automatic and each spindle is independent of the others in its action. The outfit consists of the drilling head, table, stand and chip pan. Either single- or three-speed countershaft drives can be furnished. Either No. 8 or No. $8\frac{1}{2}$ heads can be used, and either two, three or four spindle machines can be furnished. For the four spindle machine shown the length is 45 in., the height of the spindle 42 in., the spindle centers are 8 in. apart and the weight is about 800 lbs.

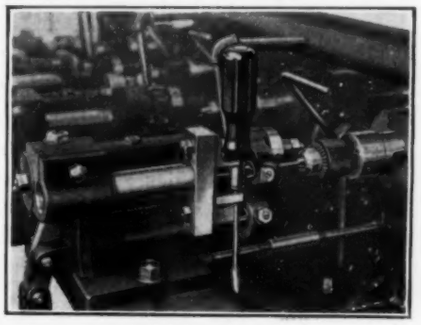


FIG. 3—KINGSBURY AUTOMATIC FIXTURE NO. 60

The arrangement is particularly adapted for the use of automatic work holding and clamping fixtures. The horizontal position of the spindles allows the chips to drop directly into the pan beneath the

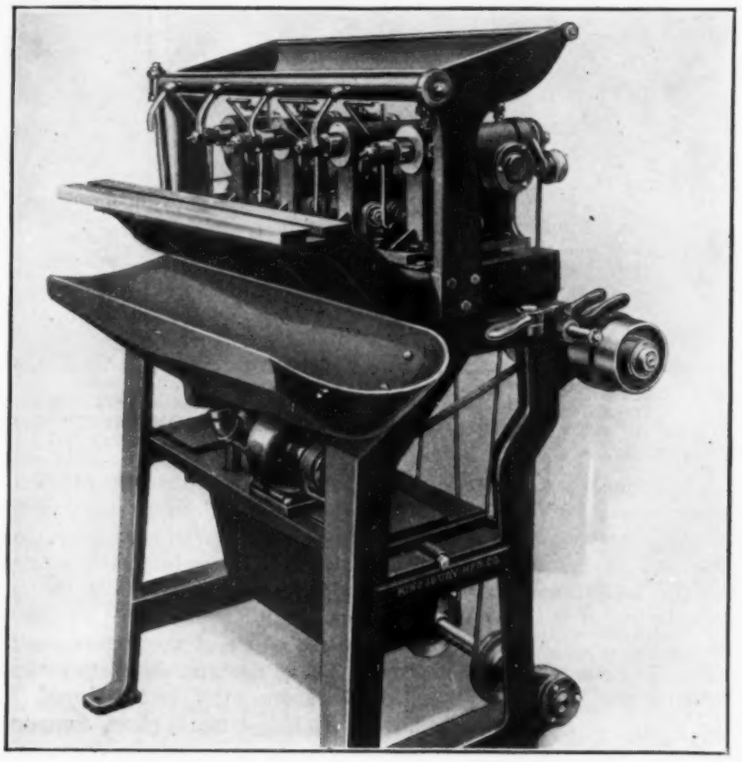


FIG. 2—KINGSBURY MULTIPLE-SPINDLE SENSITIVE DRILLING MACHINE

table. One of the fixtures which can be mounted is the No. 60 fixture shown in Fig. 3. This device is regularly equipped with V-blocks for cross drilling pins, but can be adapted for centering and other work.

The front vise jaw is adjustable longitudinally, and rigidly backs up the work. The rear jaw is mounted on a plunger operated by a stiff spring, and it contains the drill guide bushing. It is automatically opened by the drill head at the completion of the cycle. The only motion necessary for the operator is placing the work against the gages and tripping the spindle drive mechanism. As soon as the spindle is tripped, the work is automatically clamped, drilled and then ejected.

The average time for a complete cycle on brass work is only 2 sec., while a ¼-in. hole drilled through ⅜-in. cold-rolled steel would require about 6 sec. The fixture takes work up to ¾ in. in diameter, while for centering, work up to 4 in. long and 1½ in. in diameter can be held. The No. 58 fixture is similar, but is equipped with an attachment for removing the burr.

Osterholm Duplex Rotary Surface Grinder

Another adaptation of the grinding machine principles employed by W. C. Osterholm as described in the *American Machinist*, Vol. 58, No. 25, has just been introduced by Williams, White & Co., Moline, Ill. The machine is known as the duplex rotary grinder and was designed by Mr. Osterholm for automatic surface grinding of such parts as thrust washers, clutch disks, bearing races, etc. It is primarily a production machine for work that can be chucked individually or collectively within a diameter of 12 in. and a height of 4 in. The height may be increased to a maximum of 8 in. as the wheel wears.

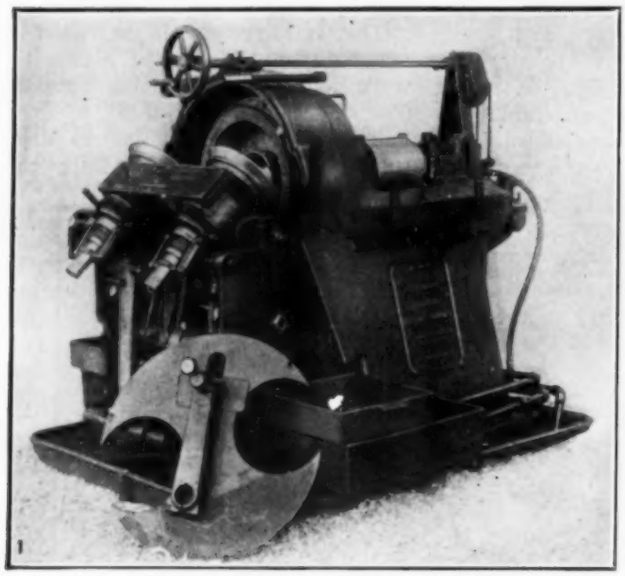
In Fig. 1 the machine is shown in the loading position with the rotary chucks at rest. As the machine is started the first fractional rotation of the cam seen at the left causes the chucks to be raised so that their faces are parallel to the grinding wheel face, and locks them in this position as shown in Fig. 2. Further rotation of the cam advances the wheel towards the work, the rate of advance being governed by the shape of the cam. The heavy cutting can be done during the early part of the cycle leaving ample time for the wheel to produce the desired finish before the chucks return to the loading position and complete the cycle. The chucks automatically drop to the loading position and the machine stops for replacement of the work.

Because of the automatic features of the design relatively unskilled operators may be employed. Where loading time is short compared with the duration of the operating cycle, it is economical to have one man operate more than one machine. Careful provision has been made for an ample supply and disposal of coolant. It is pumped through the wheel spindle and through both work spindles to flush the wheel and reduce the temperature of the work. The work chamber is practically water tight when the guards are in place and the machine is operating.

Either mechanically or magnetically operated chucks can be used. Expanding or contracting collets are operated through toggle links by the handles shown in the illustrations. Means are provided for rapidly changing the work, to minimize idle time of the machine.

Cylinder grinding wheels 20 in. in diameter are used, depth and rim thickness being varied to suit the parts to be ground. The handle on top of the water guard serves to advance the wheel to compensate for wear. Graduations on the handwheel are in thousandths of an inch. The wheel dresser as shown in Fig. 2 is always in position and is mechanically driven.

The operating cycle of the machine can be varied between 20 seconds and 2 minutes by means of the change gears shown at the left in Fig. 2. A three-step change gear is also fitted to vary the work spindle speeds from 8 to 12 r.p.m. The wheel spindle speed is from 900 to 1,000 r.p.m. Standard equipment includes pump with piping and slush pans. Also chucks as specified, countershaft and special wrenches.



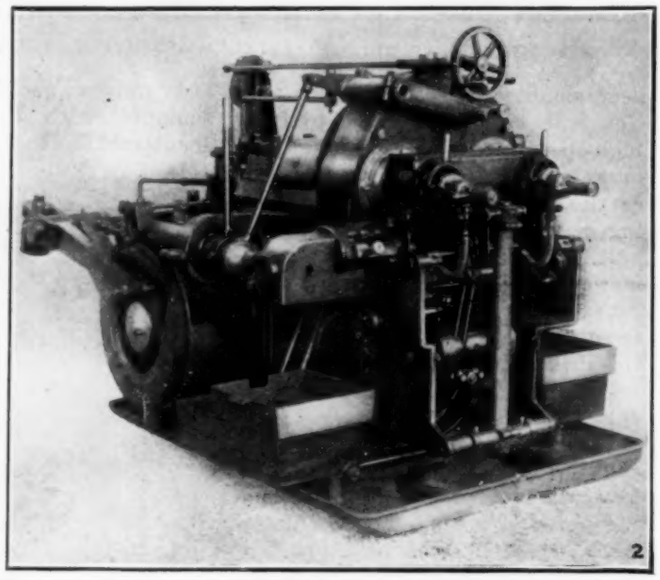


FIG. 1—OSTERHOLM DUPLEX GRINDER IN LOADING POSITION WITH WHEEL GUARD PLATE OFF.
FIG. 2—OSTERHOLM GRINDER IN WORKING POSITION.

News Section

Enthusiasm Displayed at Meeting of Society For Testing Materials

OPENING with a large registration on Monday, June 25, the American Society for Testing Materials enjoyed five days of splendid weather at Atlantic City. The meetings were some of the best ever held by the society, at times being so productive of ready discussion that they ran far over the time allowance. Several of the papers and committee reports will be printed in full or abstracted in the *American Machinist*.

At the first session the following offices for the ensuing year were announced: President, Guilliaem Aertsen, Bethlehem Steel Co., Chicago, Ill.; vice-president, W. H. Fulweiler, United Gas Improvement Co., Philadelphia, Pa. Members of Executive Committee: J. H. Chubb, Universal Portland Cement Co., Chicago, Ill.; T. G. Delbridge, Atlantic Refining Co., Philadelphia, Pa.; P. H. Walker, Bureau of Standards, Washington, D. C.; H. L. Scott, H. L. Scott & Co., Providence, R. I.

Interesting Sessions

The first session was devoted to the subject, "Non-Ferrous Metals and Alloys," and of interest to the machinery industries was the report of committee B-2 which included a statement of progress on the study of proportions and methods of casting test specimens for casting. E. H. Dix, Jr., read a paper on methods of casting test specimens of gun metal, and John R. Freeman, Jr., and Paul F. Brandt presented a paper on the influence of the ratio of length to diameter in the compression testing of babbitt metals.

"Corrosion, Fatigue of Metals and Magnetic Analysis" was the subject of the second session. J. H. Gibboney read the report of Committee A-5 on the corrosion of iron and steel, and E. C. Lathrop read the report of Committee B-3 on the corrosion of non-ferrous metals and alloys. In his paper on the endurance properties of steel, D. F. McAdam, Jr., described an extensive series of tests to determine the "endurance limit" of various carbon and alloy steels at 10,000,000 repetitions of alternating tension-compression and alternating torsion stress. Consideration was given to the relationship of endurance properties to impact properties, influence of chemical composition and heat treatment, influence of non-metallic inclusions, and influence of form and surface finish of a machinery part. Types of steel best adapted for various kinds of service were discussed. R. R. Moore gave a paper on the resistance of manganese bronze, duralumin and electron metal to alternating stresses. F. P. Fahy read the report of Committee A-8 on magnetic analysis and A. V. deForest described an apparatus suitable for the inspection of finished or semi-finished steel products in the mill.

As a part of the third session reports from the committees on wrought iron and cast iron were read. A discussion on the topic, "Is It Desirable to Include Chemical Requirements in Specifications for Cast Iron?" was led by Robert Job for the affirmative and Richard Moldenke for the negative. The decision of the society did not favor the general inclusion of chemical requirements. That they are desirable in special cases was admitted.

In their paper on the significance of tool temperatures as a function of the cutting resistance of metals, H. A. Schwartz and W. W. Flagle described an instrument for recording the changes of temperature of a drill or other cutting tool in action. It was believed that the temperature under given cutting conditions in various metals is an indication of their machine ability or cutting hardness. Data concerning typical ferrous alloys were given, including some relations between energy per cubic inch of metal removed, temperature and rate of removal of metal. The third session closed with the report of Committee A-4 on heat treatment of iron and steel.

The annual address by the president was given at the fourth session by George K. Burgess. Mr. Burgess' subject was "The Trend of Standardization." He told of the work on standardization accomplished by the A.S.T.M. and spoke of the number of A.S.T.M. standards accepted by the A.E.S.C. He referred to the limits accepted in the liberal arts and raised the question of why standardization should be opposed by industries if it is found applicable in the arts? Mr. Burgess also emphasized the importance of research and explained its relation to standardization.

Over-diversification

In a popular talk, with lantern slides, Wm. A. Durgin, of the Department of Commerce, gave examples of over-diversification. He told how it was found that there were 20,000 sizes and styles of pickle bottles, a possible variety of 994,840 single-bit axes, 298 sizes of the American flag and gave other equally illuminating figures. He gave as a conservative estimate that the loss in industry amounting to ten billions per year, due to waste, is 20 time the total annual loss of fire.

Past-President Arthur N. Talbot, Professor of Municipal and Sanitary Engineering, University of Illinois, received, at this session, honorary membership in the society.

The fifth session was devoted to the subject, "Steel and Methods of Testing." The reports of several committees were accepted and several papers were read.

Sessions six to thirteen dealt with subjects not of immediate interest to the machinery industries.

Show Large Shipments of Locomotives

The Department of Commerce announces May shipments of railroad locomotives from the principal manufacturing plants, based on reports received by the Bureau of the Census from the individual establishments.

The following table compares the May, 1923, figures with the previous month and with the corresponding month last year, as well as totals for the year to date, compared with a year ago, in number of locomotives:

LOCOMOTIVES

	May 1923	April 1923	May 1922
Shipments:			
Domestic	228	201	54
Foreign	10	16	16
	238	217	70
Unfilled orders: (end of month)			
Domestic	2,045	2,111	497
Foreign	105	93	124
Total	2,150	2,204	621

B. & O. Sells Two Branch Railroads

The Baltimore & Ohio Railroad has announced the sale of the Sandy Valley & Elkhorn and Miller's Creek Railroads to the Consolidated Coal Company and the sale of the Long Fork Railway to the Chesapeake & Ohio Railroad. The two transactions involve approximately $8,000,000, of which $6,000,000 is said to have been paid for the Sandy Valley & Elkhorn and Miller's Creek Railroads and $2,000,000 for the Long Fork Railway.

Officials of the Baltimore & Ohio said the contract was closed pending approval of the Interstate Commerce Commission. Funds from the sale, it was stated, would be used to develop Baltimore & Ohio property in West Virginia.

There will be little effect in the handling of freight developed in the Kentucky coal districts as a result of the change, it was said.

Claim I. C. C. Overstepped Authority

Officials of the Virginian Railway will ask for a rehearing of the Guyandot River Branch case, in which the Interstate Commerce Commission refused to grant permission for an extension, on the ground that coal development on this branch was unnecessary, it was stated by officials of the road. The petition now is being prepared and will be presented to the Interstate Commerce Commission next week.

While the amount of trackage is only 1.19 miles, the decision is considered of far-reaching importance by railroad men, coal land owners, and manufacturers, who assert that the Interstate Commerce Commission has exceeded its power.

Six Months Record for New York Business

Summing up the machine tool business in the Metropolitan district for the first six months of the year, reports show that it has been highly satisfactory and in many cases more than doubled the amount of business that was transacted during the first six months of last year. Several dealers report that this period has also passed any former six months in their histories both in the number of orders and the amount of money involved.

Comparing June with other months of 1923 shows that business has been slightly ahead of most of them and about 60 per cent that of May, which proved to be a banner month despite a bad start and predictions of all kinds of trouble from the pessimists.

One of the factors that, while apparently designed to be a hindrance to business will undoubtedly prove a boon, is the demand of labor for more pay. While viewed with alarm by the short-sighted, the more progressive manufacturers have merely taken the past for a precedent and have put the engineering department to work on new machinery which with greater speed and labor-saving devices will balance any demands that may be made for either shorter hours or more pay on the part of the workmen.

New England machine tool makers are well employed and most of them are optimistic as to the future. Some of the opinions from this section of the country are flavored with a seasoning of caution, but there is none of that over cautious spirit which was prevalent a few short months ago. The sensible manufacturers are looking to July and August as quiet months and are preparing their plans to meet this condition in much the same manner that they have every Summer since they began business. If a good average is maintained it will be considered highly satisfactory.

There is every indication that the Fall business will open early and brisk. Warehouses are not filled, business in all lines is progressing steadily and there is every reason to be hopeful.

In the used tool field reports have it that buying is not difficult, but that selling, except in certain sections of the country, takes additional effort.

Buffalo Business Shows Substantial Gain

Machine shops in the Buffalo district report that business is very satisfactory, although none of them seem to be rushed and one or two spoke frankly of a shortage of work as compared with the first five months of the year. However, most machine shops experience a seasonal slackening at this time of the year and even those who are not as busy as usual at this time have had enough business already this year to make them feel prosperous. There seems to be very little call for new equipment among the Buffalo machine shops and only a slightly stronger demand for used.

In the pump manufacturing line there seems to be a definite slackening, although occasional spurts during the last month or two have produced sufficient business to keep the plants running comfortably and there are many active inquiries for future large installations.

One firm making hack saws reports that its domestic business, which has been exceptionally heavy all the year thus far, is holding up and even increasing at this time.

Manufacturers of electrical apparatus and automobile parts manufacturers are buying considerable sheet metal working machinery at this time, but the automobile manufacturers do not appear to be as busy as earlier in the year and Buffalo manufacturers of light and heavy equipment for such work, who have been depending largely on the automobile industry, are experiencing somewhat of a let-down.

A representative of one of Buffalo's largest manufacturers of heavy machinery and power plant equipment reported that business was very strong, the shop was full of work and there were orders enough ahead to keep them running full time for some time in advance.

A few weeks ago this same plant reported that business had fallen off materially and while plenty of orders were being figured on there was little real prospective business in sight. This sudden reversal is just another indication of the present state of the machinery trade. The business appears to be subject and very sensitive to manufacturing vagaries that, when analyzed, seem to be little more than a state of mind. These transitory slack periods have come rather frequently since the latter part of April and are always followed almost immediately by a rush of business sufficient to make up for the slackness.

Milwaukee Business is Brisk and Steady

The machinery market in Milwaukee is assuming an aspect of increased activity, which is noticeable merely because there was an inclination in demand during May and June to slow down so far as forward orders were concerned. Now that various industries have charted their requirements for the last half of this year, orders are developing more encouragingly. In the meantime, the metal trades shops have had no occasion to reduce their production schedules; in fact, the effort to engage more men remains strong and a great many shops keep orders standing with employment agencies, public and private. In the case of the larger employers, so-called scouts are constantly on the move from one industrial center to another in the search for skilled workers, and it is true as well that other centers are doing likewise in the Milwaukee market.

Buying of floor equipment by metal trades shops still has appreciable limitations growing out of the caution exercised to prevent over-expansion of production facilities, at a time when the maximum use of these is not guaranteed for a long time ahead, and when the labor problem is a paramount one. Nevertheless, the needs appearing from time to time, despite scattering sources and confinement to replacement necessities, form a fair volume which is again showing a tendency to increase.

So relatively little railroad equipment business has come to this machinery market that disappointment is expressed, although it is recognized that the process of actually getting orders from this source on the books is rendered slow and difficult by the uncertainty surrounding the railroad situation as a whole, and particularly with regard to financing. The belief is expressed that in the coming year the situation will have clarified to the extent that a generous aggregate of machinery business is likely to find lodgment.

Demand from automobile shops is of a moderate volume, although in the big passenger car producing centers the main demand seems to be for equipment of body shops to offset the shortage of enclosed type bodies rather than to bring vehicle production upward. At the same time a number of manufacturers of units and parts in Milwaukee are steady buyers of machinery. A conspicuous example is the A. O. Smith Corp. of Milwaukee, which continues to increase its equipment for producing pressed steel frames, stampings, forgings, etc. The expectancy is that so far as the passenger automobile industry as a whole is concerned, major needs for this year have been filled and demand will be of a piecemeal character until after December.

Pittsburgh Cheerful as to Future

A feeling of optimism is present in the machinery and machine tool industry in the Pittsburgh district, notwithstanding the fact that there is a tendency in the machine tool and equipment market to hold back on purchases of material that is likely to be needed in the near future. There are several reasons for this backwardness, the chief of which is the labor shortage in the mills and plants that are good customers of machine tool jobbers and builders. Yet a number of transactions have been recorded by sellers of equipment, showing that a good inquiry is current, giving the industry a feeling of stability and sound hopes for the future.

While no very heavy orders have been placed, it is announced that the Westinghouse Electric & Manufacturing Co. at its Sharon plant has purchased hand shears, plate machinery, lathes, shapers and milling machines, while some local jobbers are still bidding on a number of items, including presses for transformer work. The Pennsylvania R.R. has deferred action on the purchase of six lathes wanted for its Conway yards. As regards used machinery, an active market has developed here lately, although prospective buyers are hesitating to close, evidently expecting lower prices in a short time. Word from Wheeling says that the Wheeling Steel Corp. has been buying some equipment in the past week or two, and in that district the purchases include shears, two or three drilling machines, a light four-foot radial drilling machine keyseaters and small lathes.

The month of July is always a slow month in steel mill operations, but as the general repairs are made at that time, it seems to augur the placing of many orders for new machinery and machine tools to replace those worn out or broken in the heavy grind of almost capacity operation which the mills have enjoyed in the past ten months .

All plants are viewing the Fall with cautious optimism and anticipate record or near record business. No labor trouble is expected in this district as the workmen appear satisfied.

Business Brightens in Britain

Better condition obtain and the future is a trifle more cheerful than it has been—English commercial motor vehicle no match for those from the United States and competing companies fail

By OUR LONDON CORRESPONDENT

THE official returns of overseas trading just issued suggest an improvement and again we are being told that the trade slump has reached its limit. Comparisons are, however, a little difficult. The Irish Free State now being a separate entity British imports from and exports to that area are, therefore, entered, while other overseas trading to or from Southern Ireland is excluded.

Taking the figures for the five months of the present year and comparing them with the corresponding figures of last year, an increase in imports amounting to about 11.5 per cent is shown, with an increase in exports of British produce of more than 6.5 per cent; or taking all exports, that is including re-exports, the increase is 7.5 per cent. The imports last month, amounting in value to about 89¼ million pounds, showed an increase of more than 3 millions. Similarly, exports were valued at about 71¼ million pounds, an increase during the month of 8¼ million pounds. Re-exports showed a small decline during the month and amounted to about 11¾ million pounds. It is to be remembered that May had 2 more working days than April.

The machine tool exports for the five months were worth £667,411, as compared with £762,863 during the corresponding period of 1922. Of the various classes into which machinery exports are divided the chief decline is in textile machinery, the difference so far this year amounting to more than 1½ million pounds.

Then, while the value of commercial vehicles imported shows but a slight increase, touring cars so far entering Great Britain this year have nearly doubled the value of those of 1922, namely, £1,598,000 as against £839,000, the total in the motor car and parts class being £3,450,331 against £2,565,580 for 1922. The total motor car and parts exports amounted similarly to £1,377,634 compared with £1,232,351 in 1922. Rubber tires were brought in to the value of £1,848,000 as compared with £1,945,000 in the same period of 1922, while the corresponding exports amounted to £881,586 and £920,908 respectively.

Hold Out Little Hope

Figures given above suggest that the prospects of manufacturers of textile machinery are not quite so hopeful as they have been. Certainly it is no longer necessary to quote delivery in three years. In fact some members of the trade may be regarded as slack. More than a year ago it was recognized that the export side was declining, but expectation was confident that in due time this would be off-set by the receipt of home orders. It may be yet. In any case for the present this branch of British industry is without undue anxiety.

Looked at generally, conditions in the engineering industry cannot be regarded as much easier. The shipbuilding industry has been handicapped by a lock-out of the boiler makers, and as a whole the branches of the industry concerned with transport have of late met varying experiences. For the locomotive shops continue slack and, incidentally, the machine tool people concerned are complaining that the amalgamation of the railway lines into four combinations has led to the concentration of purchasing power at the London offices so that the engineer in the works is not liable to order direct. To return, one well-known Glasgow locomotive works has had to close for the time being and others are hard pushed.

On the lighter side of transport, however, the motor car firms and motor cycle and ordinary pedal cycle makers have been for the most part busy, the demand having kept up beyond the usual season. Quite possibly the condition of the ordinary cycle trade has during the current year been better than in any year since the war. More than one million pounds worth of push cycles and parts has been exported so far. It has been estimated, in fact, that, with the home trade satisfactory, exports have been at the rate of 80,000 cycles per annum. Some of the firms are behind in output.

Motorcycle Conditions

The motor cycle section is hardly so optimistic, but appears to be having at least a satisfactory season, though the experiences of firms vary somewhat. The export trade in this section too is improving, amounting for cycles and parts to £457,000, but the ground lost in Europe has not yet been recovered, though Italy has ordered. Scandinavia has, it is asserted, a large number of American machines in stock, to act as a handicap. South Africa and India seem more hopeful areas and machines have been sent to the Near East. Some Midland firms have been exporting about 40 per cent of their output. Cycle makers have reduced prices—that is, wholesale prices—despite the fact that a number of raw materials employed have definitely risen in price, and the increase in turnover will not bear a corresponding increase in profits.

Taking general conditions into account the motor car industry has little cause for complaint and certain makers of lighter cars are quite fully engaged. The commercial vehicle side remains badly employed. Recently in parliament it was stated that of the 16 fair-sized British manufacturers of commercial motor vehicles, 4 last year went into liquidation and the remaining 12 between them lost more than 2¼ million pounds. Later figures suggest that 5 firms have gone into liquidation and that, while all have sustained heavy losses, two of the remaining firms have given up this particular branch of manufacture. Consequently an industry which had employed 20,000 cannot find sufficient work for 5,000.

The sale of after-war surplus is the leading cause, and many members of the industry are trying to obtain the same protection that the pleasure car has, namely, a duty of 33⅓ per cent. But this duty, imposed originally purely for war purposes, is quite insufficient to keep out foreign cars.

It is extremely difficult from the official figures to discover the exact value of imports of pleasure vehicles as compared with commercial vehicles. According to one estimate, of the total imports of this kind during 1920, amounting to nearly 23¼ million pounds worth, some 36 per cent was on account of commercial vehicles, the percentage rising to 50 in 1921, when the total imports were rather more than 5¾ million pounds, and being about 30 in 1922, when the total imports were rather less than 6 million pounds. Of course the United States is regarded as the most important competitor in this particular line and, although it is pointed out that whether as to wages paid or exchange rates the advantage is not on the side of America, the gain that accrues from the home market being completely protected is held to be overwhelming.

It may perhaps be added too that the rubber tire industry has been passing through rather critical times. While many tires are being imported, employment could be found for but a relatively small proportion of the 65,000 workpeople ordinarily engaged in an industry in which £25,000,000 to £30,000,000 has been invested.

Little change is discernible in the machine tool trade and although claims are occasionally made of improvement it is certainly not marked. Of late some districts have reported a decreasing number of enquiries, but this in itself is of no moment as the practice has grown during the past few years of inquiring merely to determine present values.

Steel Production This Year Nears Record

The American Iron and Steel Institute has issued its statement covering the operations of steel mills of the country for the full year 1922. This report showed that a total of 34,568,418 tons of steel ingots were produced last year, against 19,224,084 tons in 1921; 40,881,392 tons in 1920 and 43,619,200 tons in 1917, the latter being the record year in the history of the industry. The record total for 1917 was due to the activity of the mills in meeting the demands of the United States shortly after it entered the World War, together with the demands of its allies.

In some quarters the belief prevails that the record total for 1917 will be exceeded this year, especially if the rate of production witnessed since the beginning of 1923 is maintained during the remainder of the year. The April production this year was at an annual rate of more than 49,000,000 tons, while the May production was at the rate of 48,440,000 tons.

News of Washington Activities

By PAUL WOOTON

TWO letters of unusual importance were received by the U. S. Coal Commission last week. One was from the President urging the importance of an agreement being reached in the anthracite field. The other was from the Attorney General pointing out that it would be in violation of our statutes if the alleged agreement exists whereby British coal diggers would not mine coal for shipment to the United States during a strike here and whereby the American union would conduct itself similarly during a strike in the British Isles and coal was needed very badly.

It is very apparent that the Commission made no mistake in the appraisal of the value of the two propositions. The daily press attached great news value to the Attorney General's letter, but gave only incidental attention to the letter of President Harding. The President's letter undoubtedly was prompted by the election of Rinaldo Capellini to the presidency of District No. 1 of the United Mine Workers of America. This victory for the radicals among the workers in the anthracite region reaffirms the presence of a dangerous unrest among them, which had its first outbreak in the demand for nationalization. The fact that the radicals are in the saddle in District No. 1 increases greatly the difficulties which must be overcome before a settlement is reached. The President very evidently caught the true significance of Mr. Capellini's election. The Coal Commission is even in a better position to know its important portent. That is why its members apparently attached so much importance to the letter from the White House and seemingly dismissed the letter from the Department of Justice with the statement that they have no information as to such a contract. Chairman Hammond stated positively that John L. Lewis on appearing before the Commission, after his return from Europe, gave no intimation of having negotiated any such agreement.

Change from a coal consuming to an oil burning basis in the heating plant of a Federal Government institution in the District of Columbia is opposed in a report by the Mechanical Engineering Division of the United States Bureau of Mines, which recently conducted efficiency tests at the plant, on the ground that consideration of conservation of national resources leads to the conclusion that oil should not be used in stationary plants which show so small computed savings over coal.

By a slight change in the furnace, the Bureau of Mines engineers pointed the way to fuel economies at this plant. The tests showed variations in efficiency among the three shifts in the fireroom.

The question of changing the plant from a coal burning basis to an oil burning basis is treated in the report in two phases, the first being the economic phase covering the present and immediate future of the plant. On this phase, the report states that the plant could be changed to an oil burner at a cost of $33,500, to be amortized in five years. Assuming that oil could be contracted for at 3.5 cents per gallon, as contrasted with New River coal at $8.18 per ton, it is estimated the plant could save only $2,400 a year by changing to oil.

The second phase of the question, the broader one of the conservation of national resources, is declared by the report to be subject to the personal opinions of authorities on the matter. Regarding this, the report concludes:

"The second phase of the question, which is not concerned with the present or the immediate future, militates against the use of fuel oil in a stationary plant. Oil is one of our national resources which is limited in extent and must be conserved for military, naval, merchant marine and lubricating needs. To use it extensively in stationary plants brings nearer the time when the supply will be exhausted and the above needs for its best use will have to seek supplies in some other form.

"At present oil prices are low, and therefore favorable to plants desiring to change from solid to liquid fuels, but no one can predict how long such conditions will exist. It is certainly true that a plant changing from coal to oil now will have to revert to coal again in the not too distant future. It seems advisable from a national resource standpoint that this plant continue on a coal burning basis and bend their energies toward improvement in coal efficiency rather than seek a change to fuel oil."

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb....	$0.034	$0.034	$0.0231
Cold finished shafting.....	per lb....	0.042	0.042	0.0034
Brass rods.....	per lb....	0.1825	0.1913	0.1783
Solder (½ and ½)	per lb....	0.2862	0.2812	0.22
Cotton waste...	per lb....	0.1231	0.1231	0.101
Washers, cast iron (¼ in.)...	per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100...	3.08	2.96	3.11
Lard cutting oil	per gal...	0.608	0.592	0.575
Machine oil....	per gal...	0.349	0.349	0.356
Belting, leather, medium.....	off list....	42½%	42½%	46⅔%
Machine bolts up to 1x30 in.	off list....	44¼%	44¼%	58%

Recommendations for the elimination of a number of sizes of structural and partition units made of concrete were endorsed by committees representing the Concrete Products Association and the American Concrete Institute at a preliminary meeting held June 21 with the Division of Simplified Practice of the Department of Commerce. The committees expressed a desire for a general meeting of all interests concerned in the subject next October to consider adoption of the recommendations.

The tentative recommendations are the result of a survey made under the direction of Wallace R. Harris, chairman of the committee on standard building units of the American Concrete Institute. This survey showed concrete blocks made in 30 different lengths, 20 widths and 26 heights.

The tentative recommendations for foundation units are height 7⅝ in., length 15⅝ in. with wall thicknesses of 8 and 12 in. For load bearing wall units the recommendations are height 7⅝ in., length 15⅝ in.and wall thicknesses of 6, 8, 10 and 12 in. For load bearing concrete structural tile the recommendations are for height 5 in., length 11½ in. and wall thicknesses of 4, 8 and 12 in. For concrete partition tile (non-load bearing), the recommendations are height 7⅝ in., length 16, 18 and 24 in. and width 3, 4, 6 and 8 in.

Attending the preliminary conference were: Herbert A. Davis, representing both the Concrete Products Association and the American Concrete Institute; C. E. Lindsley, American Concrete Institute; L. L. Wagner and John L. Miner, Concrete Products Association; P. E. Holden and E. W. McCullough, Chamber of Commerce of the United States; and R. M. Hudson. assistant chief of the Division of Simplified Practice, Dept. of Commerce.

F. A. E. S. Protests Davis Dismissal by Work

Protest by the Federated Engineering Society, representing 50,000 members in the United States, was made to Secretary Work against the summary dismissal recently of Arthur P. Davis as director of the Reclamation Service, and the appointment of a business man without technical knowledge of irrigation or constructive work connected with it.

The protest was presented by L. W. Wallace, executive secretary of the Society, to the Assistant Secretary of the Interior in the absence of Secretary Work, en route to Alaska.

The society intends to demand a thorough investigation and explanation of Secretary Work upon his return. This investigation, the officers of the society say, is not expected to bring about the reinstatement of Mr. Davis, but is aimed to call attention of the public to a changed policy, which if continued would discourage technical men entering the Government service and in the end cripple the efficiency of public activities.

Other engineering societies are expected to join the formal protest lodged by the Federated Society. The nation-wide agitation against the action of Secretary Work set in motion by technical men will, in the opinion of members of Congress now here, lead to a thorough investigation by Congress early next December.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THE hysteria of alarm by which Wall St. has recently been afflicted reached the climax of absurdity on June 26, when a professional prophet who sells his predictions announced that "we now advise clients who are unwilling to carry their stocks through a possible year of lower prices to sell immediately on every rally."

Inasmuch as the author of this rather startling advice had been predicting higher prices ever since March 6, when the market was an average of 10 points higher, it was assumed that his sudden change of front indicated a preknowledge of some very importance and unfavorable development. If this does not prove to be the case he should be severely censured for unnecessarily aggravating the mistrust caused by the failures of the previous week, and the unfortunate "clients" who sold on his advice will have just cause to complain of his bad judgment as expressed in his bulletins during the last two and a half months.

Certainly there is nothing to be discerned that justifies pessimism at present, and if one must speculate in the stock market, which is always hazardous, it would seem to be far wiser to buy than to sell.

In support of this view reference is made to the following facts:

1. The large business indicated by the unprecedented railway traffic and increased net earnings of the roads, which are still gaining.

2. The fact that practically everyone who is willing to work is employed at good wages.

3. The large sales reported by the department stores who are doing a much bigger business than a year ago.

4. The abundant supply of credit assured by the reserve ratio of 76.9 per cent reported by the Federal Reserve System last week. The percentage of reserves to liabilities has apparently been but little affected by a loss of nearly $19,000,000 in the gold held. The reduction is presumably due to continued disbursement of "yellow backs" by the banks who are trying to conceal our plethora of gold by getting it into circulation.

5. The gradual subsidence of the scare caused by the failure of two moribund banking firms and the wild rumors deliberately circulated about others of unquestioned standing.

6. The decline in the stock market recorded since early in March. It runs all the way from 5 to 25 per cent and justifies the expectation of a recovery.

Those who can interpret the foregoing bearishly are welcome to make the most of it, but it is highly improbable that the hard-headed business men who are outside the environment of Wall Street will be driven into a panic by the outgivings of those who would not need to sell their advice if it was infallible.

The wise man will of course make allowance for accidents in appraising every situation, but the recent decline in the stock market seems to have discounted nearly everything but a world wide cataclysm and we had so many cataclysms during the seven years ending with 1921 that humanity is tired of them and will be on guard against any more such happenings in the near future.

This may explain the recent nervousness of the speculative markets, but it is also a guarantee against dangerous expansion and the peril of a sudden collapse.

> "If it were possible to make a balance sheet of the world's condition today and compare it with a similar statement made up six months ago, we should probably find that the sum total of human wealth had been substantially increased in the interval. . . We are reducing our national debt rapidly, the government is a little more economical, there is a faint hope of lower taxes and we can be thankful that we are not going backward."

Restrained by this cautionary spirit prices swung within narrow limits last week. In the steel industry the extreme heat compelled some short time, but the mills are well sold ahead and leading manufacturers say that they will be fully employed to the end of the year. The weakness of copper, which is attributed to the diminished purchasing power of Europe, is in fact the only unsatisfactory feature of the metal market, as the relatively low price of wheat is about the only thing of which the farmer can now complain with reason.

They are both due to the economic disorder and impotence of Europe, which time alone will remedy.

Corn and cotton are both selling at prices which will pay the industrious farmer a comfortable profit unless there is a serious crop failure. As to corn, it is too early to speak positively, but cotton appears to have stabilized itself at between 20 and 25 cents for the next crop, with a possibility of substantially higher prices if current crop estimates averaging probably 10,750,000 bales are not greatly exceeded.

Coffee and sugar are not much changed. The price of coffee depends upon the Brazilian Government and opinions of its intention and ability to sustain prices vary from day to day.

Sugar is not cheap but it is not dear and with care the unsold portion of the Cuban crop can probably be marketed around present prices.

There is a conflict in my opinion about wool. Prices in London show a declining tendency, but Mr. Wood of the American Woolen Co., who is the world's largest buyer, says that trade is good and that there is no reason for any decline.

The cotton goods market is hesitant and will probably remain in that condition until buyers know what the next crop will be.

The news from Europe lacks sensationalism, but does not indicate that much progress is being made toward finding a key for the Franco-German deadlock. With marks selling at 150,000 for a dollar and over thirteen trillions in circulation they can not any longer be considered as a medium of exchange. They are of interest chiefly as an example of Germany's ingenuity in marketing the product of its paper factories.

The trade reports received from England, and especially Lancashire, are characteristically lugubrious, but Great Britain is nevertheless muddling through and the buoyancy of the London stock market seems to indicate that some Englishmen are making money.

Private advices from Russia are surprisingly encouraging and indicate a distinct renaissance of industrial activity now that the capitalistic regime has been re-established.

If it were possible to make a balance sheet of the world's condition today and compare it with a similar statement made up six months ago we should probably find that the sum total of human wealth had been substantially increased in the interval. Some items would be larger and some smaller, but on the whole the comparison would show progress.

This is all we can ask and though "man never is but always to be blest" there is some satisfaction in the thought that the world in general and America in particular is better off at the end of the half year than they were six months ago.

We are reducing our national debt rapidly, the government is a little more economical, there is a faint hope of lower taxes, and while we have still a good many things to complain of we can at least be thankful that we are not going backward as we resolve to go forward more rapidly in the future.

Costly to Test New Coal

Only thorough trial on a large scale and at great cost can determine the worth of Henry Ford's project for low temperature carbonization of coal on a commercial basis, according to Dr. Jerome J. Morgan, member of the American Chemical Society, and professor of chemical engineering in the School of Mines, Columbia University.

Germany and Her Export Trade

Radical changes have taken place in the foreign business of Germany since the war—Speculative buying by neighboring countries—Heavy machinery still the rule

BY OUR BERLIN CORRESPONDENT

THE year 1923 opened under unfavorable auspices for the foreign machinery trade. During the last months of the past year actual shipments on foreign orders were still strong, running up to the record figure of 13,574 tons in December, but a certain weakening of the market was unmistakable. It may be assumed that, even if normal conditions had continued, the export business would have shown a marked drop.

The Ruhr occupation has certainly reduced the credit, which the German machine building industry enjoyed abroad, and, by plunging the country into a series of adverse conditions, which viewed from outside assume even a graver aspect than actual experience warrants, has proved almost fatal to the export business. If this does not find stronger expression in the foreign trade returns of the German machine building industry for the first three months of the year, it is for the reason that the shipments of these months constitute in the main deliveries on orders booked for in advance.

From the following figures, giving the German machine export for January, February and March, with the monthly average of 1922 and 1913 attached for the sake of comparison, a gradual drop is, however, clearly visible.

TABLE I

	January	February	March	Monthly Average	
	Metric Tons			1922	1913
Machinery total	34,682	26,115	29,279	40,910	46,226
Textile machinery	3,879	2,939	3,862	3,554	5,702
Locomotives and tenders	3,429	1,572	1,037	8,438	4,844
Machine Tools	5,485	4,555	4,303	6,514	6,195
Agricultural machinery	3,032	2,334	2,657	2,868	3,392
Electric machinery	2,153	2,456	2,321	1,975	3,101
Motor vehicles	1,478	1,391	1,134	1,634	1,274
Cycles	1,551	1,189	1,392	1,344	811

The subdivision of these exports into main groups visible in Table I shows that the various branches of machine building were affected rather unequally. The general downward tendency can, however, be clearly recognized, especially in comparison with the monthly average of 1913. If remembering, however, that beginning with February the whole German west, as far as it is occupied, is practically eliminated from the export business, which in consideration of the size of the industry in these parts would lead to expect much graver effects, the above quoted figures give an excellent illustration of the power of resistance inherent in the German industry.

Only in the locomotive industry can a serious drop be observed, especially in comparison with last year's record business, as a direct consequence of the strangling of the Rhenish-Westphalian export. As far as the machine tool industry is concerned, the occupied parts contribute to the production and consequently to the export a by far smaller percentage than in the matter of heavy machinery.

In the Ruhr district proper there is only a small number of works of minor size. The Rhenish machine tool industry is located in the main in and near Düsseldorf and Cologne. These works, although faced with a great deal of difficulties, have found an outlet for their production at least in part, which makes their situation less precarious than it would seem viewed from outside. The machine tool production in the occupied parts constitute no more than about 15 per cent of the German total. The main centres in Saxony, Greater Berlin and South Germany are removed from the abnormal conditions prevailing in the occupied zones. The decline of the machine tool export, exhibited in the figures in Table I, is therefore attributable in the main to market conditions. A clear insight into these conditions can be gained from Table II, which shows machine tool exports during the first three months of the year, grouped with regard to countries of destination, with the corresponding exports of the first quarter of the three preceeding years and of 1913 attached.

TABLE II

		Jan.	Febr.	March	January–March 1923	1922	1921	1920	1919
Alienated German territory		287	126	197	653	737	228	518	...
Belgium		295	51	40	386	2,397	2,961	1,779	1,323
Denmark		127	77	83	287	395	266	577	284
France		570	888	89	1,547	1,574	1,910	2,915	3,971
Great Britain		181	298	198	677	683	416	375	755
Italy		177	117	160	453	3,155	1,101	1,544	1,286
Netherlands		320	159	163	641	1,311	1,359	3,971	1,351
Norway		28	53	34	115	81	128	343	241
Roumania		53	94	30	177	283	164	50	133
Sweden		48	36	60	144	393	241	1,278	346
Switzerland		201	139	167	507	539	574	2,489	703
Spain		77	115	98	290	423	372	700	286
Former Austria-Hungary	Austria	280	205	234	719	1,017			
	Hungary	50	43	29	122	60			
Austria Hungary Former Russian Empire	Czechoslovakia	62	137	130	289	770	1,642	1,786	2,936
	Jugoslavia	6	25	11	42	163			
	Russia	33	16	46	95	23			
	Poland	154	191	146	491	95			
	Lettonia	19	20	33	72	136	212	213	2,191
	Finnland	40	61	12	113	72			
Egypt		4	10	24	38	25	...	...	...
British India		72	13	7	92	63	...	...	...
Japan		53	29	201	283	188	57	25	137
Dutch Indies		132	8	19	159	206	195	276	421
Argentine		163	60	118	341	401	170	223	422
Brazil		90	94	75	259	194	...	...	...
U. S. A.		138	132	196	466	305	97	97	239
All others		444	273	346	1,065	994	1,096	843	827
Total		5,485	4,555	4,303	10,377	16,593	13,089	19,992	17,852

Close reading of the figures in Table II lays bare the astounding history of the post-war German machine tool trade in comparison to pre-war times, whereby it has to be remembered, that the year 1913, to which the figures in Table II make comparison, was one of a record business. From the total of the figures it can be seen that the year 1920 has in actual volume of business surpassed all others. Reaction followed in the subsequent year, superseded by a partial recovery in 1922. In comparison with that year, the drop of this year's export is rather striking, in fact the export of the first 3 months of 1923 constitutes the low-water mark of all post-war years with the exception of the year immediately following the end of the war.

The most interesting feature in the German machine tool export of previous years is the part played by the surrounding neutral countries, Holland, Norway, Sweden, Switzerland, which alone in 1920 have purchased considerably more German machine tools than ever before and evidently much beyond their own needs, exhibiting the speculative character of a great part of such purchases.

In the subsequent years these exports have dwindled down to a normal state and even below. This fact explains in a large degree the decrease of the German machine tool exports since 1920. Another feature is the steady increase of exports to Italy and Belgium to far above the pre-war average. The drop visible in comparison to last year in both cases is rather marked. While in the case of Belgium it has certainly been caused in a measure by the economic war, it can in that of Italy be solely due to changed market conditions.

Of further interest is the size of exports to the states of the former Russian Empire. The purchases of the

TABLE III

	Jan.	Feb.	Mar.	January–March 1923	1922	1921	1920	1913
Netherlands	2	4	..	6	54	...	...	...
Austria	1	2	1	4	45	27	50	37
Switzerland	5	2	5	12	15	32	18	146
U. S. A.	8	22	..	30	82	13	17	1,195
All others	22	8	33	63	112	56	147	395
Total	38	38	39	115	308	128	252	1,773
Number	70	52	44	166	397	...	...	2,473

Soviet Republic appear insignificant and far below expectation. If exports to Poland seem considerably increased in comparison to last year, it must be remembered, that the increase is chiefly due to the fact that the supply to alienated parts of Upper Silesia is now listed as exports.

The number of machine tools exported during the first three months of the current year is 27,058, the average weight per tool therefore is 383 kg. This average weight last year was 600 kg. and in pre-war years about 700 kg. The decrease in average weight is no mere chance or due to reduction of weight, but to the preference given to lighter types. German machine tool makers have with few exceptions so far done nothing to economize in weight, but are still dimensioning their designs in the old overgenerous way.

In comparison to exports, machine tool imports still play an insignificant part, as can be seen from the figures in Table III.

While in the first three months of 1913, 2,473 tools weighing 1,773 tons were imported, the corresponding amount in the first three months of the current year was only 166 tools weighing 115 tons or not more than from 6 to 7 per cent. The main countries of origin are the U. S. A., Switzerland, Austria and Holland.

Personals

HOWARD ADT, president, the Geometric Tool Co., New Haven, Conn., has taken his family with him on a two month's business trip to Europe. He sailed June 23 on the George Washington.

ROBERT CRAMER, vice-president and chief engineer of the Cramer Mfg. Co., pumps and accessories, Milwaukee, has been appointed a member of the Sewerage Commission of the City of Milwaukee.

C. M. KNIGHT, general manager of the Burlington (Wis.) plant of the Universal Can Co., has also been appointed general manager of the Burlington branch of the Nestle Food Co. The Universal company is a subsidiary of the Nestle interests.

W. D. LEGGE, since 1917 master mechanic and tool designer for the Four Wheel Drive Automobile Co., Clintonville, Wis., has resigned to accept a position with the Tuttle Press Co., Appleton, Wis.

FRANKLIN S. TERRY, co-manager of the National Lamp Works, Cleveland, Ohio, was elected vice-president of the General Electric Co., and B. G. Tremaine, also co-manager of the National Lamp Works, was elected a director of the same company at a meeting of the board of directors held June 22 in New York City.

COL. D. H. SAWYER has been appointed secretary of the Associated General Contractors of America effective July 1, according to announcement by Gen. R. C. Marshall, Jr., manager of the Association. He will succeed Eugene Young, who recently resigned the office to enter private business in Minneapolis.

NOAH W. ELLIOTT has been elected president of the Elliott-Blair Steel Co., New Castle, Pa., succeeding George D. Blair, who sold his interest in the company and retired April 30. Mr. Elliott has been engaged in the iron and steel business for more than 40 years, chiefly in the manufacture of cold rolled strip steel.

RALPH B. ROSE, assistant general agent in charge of the bureau of bars and hoops, order and shipping department, Carnegie Steel Co., has resigned on account of ill health. He was formerly with the Carbon Steel Company.

CRAIG GEDDIS has been appointed assistant sales manager of the Monongahela Tube Co., Armco ingot iron department, Pittsburgh.

M. O. GUMBALL, formerly with the Detroit Lubricator Co., Detroit, has organized the Geometric Metal Products Co., Hawthorne, Calif., and will specialize in screw machine products.

JOHN BERGSTEN, until recently with the Standard Oil Co. has organized the Standard Tool & Supply Co. at Torrance, Calif.

THOMAS CROWTHER, a well known machine tool selling agent of Lawrence, Mass., has retired from active business and will move to Brattleboro, Vt., shortly. Mr. Crowther has spent a large portion of his 70 years in the machine tool industry.

M. A. SCHENK of the Royal Dutch Petroleum Co., The Hague, Holland, sailed June 26 on the Berengaria after a four months' visit at the Asiatic Petroleum Co. offices in New York.

JULIUS J. GOETZ has been appointed trustee of the bankrupt estate of the American Metal Parts Mfg. Co., Milwaukee, that on June 12 was adjudicated bankrupt.

J. R. VIETS, for many years in charge of the shipping department of the Lynn Works of the General Electric Co., and more recently traffic representative for the New England district, has been appointed assistant traffic manager with headquarters at River Works, West Lynn, Mass.

CHARLES T. BUSH, of C. A. Strelinger & Co., Detroit, sailed with his family on the George Washington, June 23, for a two months trip to Europe.

Business Items

Announcement is made that the Electric Furnace Co. plant at Salem, Ohio, has been purchased by F. A. Holles and R. F. Benzinger, both of Alliance, Ohio, and F. T. Cope of Salem. The plant has been inactive since last March. Improvements will be made and new machinery installed.

Incorporation of the Canton Metal Products Co., Canton, Ohio, is announced, with a capitalization of $200,000. It will engage in the manufacture of general metal products, mostly for the automotive industry. Harry Nusbaum and Frank A. Zink are the incorporators.

Stockholders of the Defiance Machine Works of Defiance, Ohio, have voted for refinancing and reorganizing the plant. The plans call for a $600,000 bond issue and the appointment of a new board consisting of S. O. Richardson, Jr., of the Libby Glass Co., Toledo, Ohio, Henry L. Thompson, president of the Boswick-Braun Hardware Co., Toledo, and Bingham Co. of Cleveland, and chairman of the board of directors of the Willys-Overland Corp., Charles E. Bunting, president of the Bunting Bronze Co., Toledo, Ohio, Edward S. Marshall, attorney of the law firm of Marshall & Frazer, Toledo, Ohio, and E. M. Hummer, present receiver of Defiance Machine Works, Defiance, Ohio.

The Connecticut Blower Co., Hartford, Conn., has been incorporated in Delaware with a capitalization of $250,000. M. E. Keeney is president, C. H. Keeney is treasurer and C. E. Keeney is secretary.

The Foss Machinery Co., Montreal, Canada, has been appointed exclusive representatives for the Rockford Tool Co., Rockford, Ill.

The Central Sales office, Navy Yard, Washington, D. C., announces a sale of hand tools including many varieties, bids to be opened at 11 a.m. July 11.

The Blakely Manufacturing Co. of Detroit has purchased the stamping machinery and equipment of the Liberty Stamping & Manufacturing Co. which it is removing to its new factory at Fullerton Ave. and Monnier Road.

The yearly gathering of representatives and salesmen of the Goddard & Goddard Co. was held at the home office in Detroit, June 14 and 15, under the supervision of C. S. Goddard, sales manager.

The Elk Manufacturing Co. of New York City has been taken over by the Elk Machine Tool Corp. with increased capitalization.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Cotton-gin. Vera Cruz, Mexico. Purchase. Reference No. 6892.

Grinding machines. Copenhagen, Denmark. Agency. Reference No. 6890.

Labor-saving tools and machinery. London, England. Agency. Reference No. 6880.

Lathes. Copenhagen, Denmark. Agency. Reference No. 6897.

Machine tools and technical articles. Copenhagen, Denmark. Agency. Reference No. 6884.

Sawmill machinery equipment. Mazatlan, Mexico. Purchase. Reference No. 6895.

Textile machinery. Ghent, Belgium. Purchase. Reference No. 6930.

Wood and metal turning machinery. Warsaw, Poland. Agency. Reference No. 6919.

Woodworking machinery and machine tools. Liege, Belgium. Agency. Reference No. 6938.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Steel—General price level remains unchanged. Bars still quoted at $2.40 per 100 lb., with plates and shapes at $2.50, on new contracts. Price tendency on structurals has been slightly lower recently; inquiries, however, have improved, during the last week. Steel mill operations at about 89 per cent of capacity, against 94 per cent eight weeks ago. Considerable improvement in new plate business, mostly in small lots. Car material still holds lead for demand with tank plates next.

Advances—Price of gray iron machinery castings advanced in New York, Cleveland and Detroit, due to higher labor costs. Antimony advanced ½c. per lb. in New York during week, owing to improvement in demand.

Declines—Recent declines in pig iron due mostly to increased production and unusually large old-material supply; present market, however, trifle steadier. Non-ferrous metals market generally weaker. Copper, tin, lead and zinc all tending downward. Fabricated brass and copper also lower due to drop in metals. Raw linseed oil quoted at $1.13 per gal. (5 bbl. lots) f.o.b. New York, against $1.16, one week ago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.05
Northern Basic	29.77
Southern Ohio No. 2	30.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.25
BIRMINGHAM	
No. 2 Foundry	27.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	30.76
Virginia No. 2	34.17
Basic	28.26
Grey Forge	28.76
CHICAGO	
No. 2 Foundry local	31.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	32.51
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	29.77
Basic	28.77
Bessemer	30.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	6.75@7.40
Cincinnati	6.75
New York	5.50@7.00
Chicago	4.00@5.00

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21.	3.70	4.95	4.45	4.85
Nos. 22 and 24.	3.75	5.00	4.50	4.85
Nos. 25 and 26.	3.80	5.05	4.55	4.90
No. 28	3.85	5.15	4.65	5.00

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00	5.15	4.70	5.10
Nos. 12 and 14.	4.10	5.25	4.80	5.20
Nos. 17 and 21.	4.40	5.55	5.10	....
Nos. 22 and 24.	4.55	5.70	5.25	5.65
No. 26	4.70	5.85	5.50	5.80
No. 28	5.00	6.15	5.80	6.10

WROUGHT PIPE (Welded)—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	62	50½	⅜ to 1½	30	13
LAP WELD					
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	60	49½	⅜ to 1½	30	14
2 and 3	61	50½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods(base)	7.50@8.00	8.00	7.35
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.30
Cold finished flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.32½
Soft steel bar shapes (base)	3.54	3.36	3.32½
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.71	3.40
Bar iron (3.25 at mill)	3.54	3.36	3.32½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, $\frac{5}{32}$, 8½c.; ½, 7.85c.; $\frac{5}{32}$ to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			39.75
Lead (up to carlots), St. Louis	6.70	New York	7.37½
Zinc (up to carlots), St. Louis	5.80	New York	6.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	27.50
Antimony (Chinese), ton spot	8.00	10.50	8.25
Copper sheets, base	25.25	23.75@24.00	23.00
Copper wire (l.c.l.)	18.12½	21.00	16.25
Copper bars (l.c.l.)	22.00	24.25	19.50
Copper tubing (l.c.l.)	27.00	29.25	23.00
Brass sheets (l.c.l.)	19 75	24.25	18.75
Brass tubing (l.c.l.)	25.50	29.75	20.50
Brass rods (l. c. l.)	18.00	21.00	15.75
Brass wire (l. c. l.)	20.25	22.00	.....
Zinc sheets (casks)	10.25	10.10	.....
Solder (½ and ½), (caselots)	31.50	29.50@31.50	20.00
Babbitt metal (83% tin)	56.00	51.00	40.00
Babbitt metal (35% tin)	30.00	17.50	16.00
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	35.00
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	12.75	12.00
Copper, heavy, and wire	13.25@13.75	11.75	11 00
Copper, light, and bottoms	11.25@11.75	10.00	10.00
Lead, heavy	5.00@ 5.50	5.00	5.75
Lead, tea	4.50@ 4.75	4.00	4.75
Brass, heavy, yellow	7.50@ 7.75	....	7.50
Brass, heavy, red	11.00@11.50	10.00	9.50
Brass, light	6.00@ 6.50	5.50	6.50
No. 1 yellow brass turnings	7.50@ 7.75	6.50	7.00
Zinc	3.75@ 4.25	3.50	3.50

TIN PLATES—American Charcoal—Bright—Per box.

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 20x28, 112 sheets	$23.50	$19.50	$18.50
"A" Grade:			
IC, 20x28, 112 sheets	21.00	17.00	17.00
Coke Plates—Primes, 20x28 in.:			
100-lb., 112 sheets	14.00	12.60	14.50
Terne Plates—Small lots, 8-lb. Coating			
IC, 14x20	8.25	6.55	7 40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11¼
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13½x13½, per lb.	11.25	36.00 per M	.10
Wiping cloths, 13¾x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	1.13	1.27	1.28
White lead, dry or in oil	100 lb. kegs.	New York, 14.50	
Red lead, dry	100 lb. kegs.	New York, 14 50	
Red lead, in oil	100 lb. kegs.	New York, 16.00	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.50@5.25	
Coke, prompt foundry, Connellsville	per net ton	5.75@6.25	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅝ and smaller	60%	.....	..
Semi-finished nuts, ¾ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3 50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, ⅞ in. dia. and smaller	40%	50-10%	60%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30-10%	30-10%	30-10%
Heavy grade	20-5-2½	30%	20-5-2½%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1 40
Cloth	3.38	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ark., Searcy—Kelly Lumber Co.—lumber mill machinery and equipment, including saws, planers, etc.; machine shop equipment, including lathe, press, drill, machine tools, etc.

D. C., Wash.—Maculson Co., Inc., 2103 14th St., N. W.—buffing and polishing machine, drill press and cylinder grinder.

D. C., Wash.—Peevles Motor Co., 1501 14th St., N. W.—buffing and polishing machine, drill press and bench tools.

Fla., Tampa—Tampa Bay Fertilizer Co., S. W. Allen, Pres.—machine shop equipment, including lathe, drill, press, machine tools, etc.

Ill., Danville—Modern Machine Shop, 22 Harrison St.—complete equipment, including lathes, presses, welders, drills, grinders, etc. for 2 story plant.

Kan., Sterling—Daenzer Motor Co., C. H. Daenzer, Purch. Agt.—power metal drill press, power metal lathe, emery stand, hangers, belting, pulleys, bearings, shafting, cylinder grinder and small hand tools.

La., New Orleans—Todd Eng. Dry Dock & Repair Co., South Peters and Howard Sts.—$300,000 worth of machine tools for ship and other repair work.

Mich., Detroit—Bd. Educ., 1354 Bway. Ave., C. A. Gadd, Business Mgr.—eight Worcester semi-quick change lathes, swing 14 in., bed 8 ft., single back gear, cone pulley, standard Worcester front and rear bearings; one face plate, centers, Morse feed No. 2; carriage equipped with power feed and cross feed compound; tool block, travel not less than 4 in.; one 8 in. four jaw chuck.

Mich., Detroit—Fruehauf Trailer Co., 1094 Harper Ave.—machine shop equipment for plant expansion.

N. Y., Buffalo — J. M. Navadel, 3205 Bailey Ave.—additional machinery, tools and equipment for garage and repair shop.

N. Y., Jamestown—K. Ingerson, c/o Cold Springs Garage, R. 75—small machine tools and equipment for automobile repair.

N. Y., Jamestown—Jamestown Regulator Co., Wellman Bldg., F. H. Garfield, Dir.—machine shop equipment.

N. Y., New York—Columbia Button Wks., 49 West 27th St.—plating dynamo and automatic drop hammer.

N. Y., New York—Standard Oil Co. of New York 26 Bway., A. E. Carr, 1001 Stowell St., Elmira, Local Mgr.—complete equipment, including lathe, press, drill and small tools, for proposed $55,000 machine shop at Elmira.

N. Y., Olean — Meiers-Barrett Co., West State St.—tinshop and hardware repair shop equipment.

N. Y., Rochester—Manufacturer's Tool & Die Corp., South Water St., A. W. Fromani, Pres.—machine tools, also die plant machinery and equipment, to replace that which was destroyed by fire.

N. Y., Rochester—Powertown Tire Sales Corp., 253 East Ave.—machinery, tools and equipment for tire repair and service station.

N. Y., Salamanca—West End Service Sta.—garage, repair shop and service station machinery, tools and equipment, including air compressor, lathe, machine tools, etc.

O., Kenmore—Ohio Gear & Machine Co., H. H. Johns, Dir.—machine shop and gear works machinery and equipment.

Pa., Canonsburg—J. Hoxworth—complete garage and repair shop machinery and equipment, including lathe, drill, press, air compressor, small machine tools, grinder, etc.

Pa., Columbia—Gibbs Metal Container Co.—metal working machinery and equipment for plant for the manufacture of metal cans, etc., on 10th and Blunston Sts.

Pa., Erie—Northwestern Motor Sales Co., 21st and State Sts.—garage, repair and machine shop machinery, tools and equipment, including lathe, drill, press, air compressor, grinder and small tools.

Pa., Hamburg—Hamburg Boiler Wks., Inc.,—plate bending roll, 62 in. between housings to bend ¼ in. plate to a 10 in. circle.

Pa., Youngsville—M. C. McClure—lathe, press, drill, air compressor, small machine tools, grinder, etc., for garage, repair and machine shop.

Tex., Whitewright—L. O. Lackey (tinner)—8 ft. cornice brake.

Va., Ashland—Fuqua & Stone—Small lathe, electric hand drill and drill press for automobile repair work.

Va., Ashland—Rawlings Motor Co., A. Rawlings, Purch. Agt.—small lathe and welding outfit.

Va., Richmond—W. B. Alkinson, 322 West Broad St. (automobile repair work)—lathe for metal work, also grinding in machine.

Va., Richmond—Amer. Garage, 311 North Henry St.—lathe for metal work.

Va., Richmond—Bittner Motor Car Shop, 301 North Gilmer St.—arbor press and small lathe.

Va., Richmond—Broad St. Bicycle Wks., 506 West Broad St.—lathe and air compressor.

Va., Richmond—Carr Auto Spring Co., 920 West Broad St.—drill press, power shears for metal, also grinder.

Va., Richmond—Chaddick Motor Supply Co., 713 West Broad St.—power suction vacuum cleaner, also drill press.

Va., Richmond—Cornice Repair Shop, 313 North Smith St.—drill press for automobile repairs.

Va., Richmond—Evans & Kramer, 932 West Broad St.—18 in. lathe, power saw for metal work, dividing head, with vertical milling attachment.

Va., Richmond—D. A. Heath, 522 West Broad St.—drill press for automobile repairs.

Va., Richmond—Night & Day Service Co., 30 Graham St. (automobile repairs)—drill press.

Va., Richmond—J. E. Quarles, 510 West Broad St. (bicycle repair shop)—drill press, compressed air pump, emery wheel and stand.

Va., Richmond—Radiator Repair Shop, 712 West Broad St.—small lathe, bench tools and air compressor.

Va., Richmond—F. D. Schluter Auto Welding Co., 922 West Broad St.—drill press and lathe.

Va., Richmond—Service Co., 820 West Broad St.—grinder, medium size lathe and bench tools for automobile repair work.

Va., Richmond—C. H. Swink, 910 West Broad St.—compressed air drill.

Va., Winchester—Shade Motor Co.—welding outfit and lathe for metal work.

Va., Winchester—Winchester Automotive Machine Wks.—die making machine and welding outfit.

W. Va., Wheeling—Kerr Portland Cement Co.—machine shop equipment, including lathe, press, drill, etc.

Wis., Milwaukee — Frankenburg Refrigeration Mchy. Co., c/o G. A. Gessner, 97 Wisconsin St.—machinery and tools for the manufacture of ice machines.

Wis., Racine—Luedtke Bros., 1202 North Main St.—small power drill press, air compressor, emery stands and hand tools for automobile repairs.

Que., Berthierville—J. Salvas, William St.—equipment for automobile repair shop.

Que., Grand Mere—S. Mailhiot, 16 Laing St.—machine and blacksmith shop equipment.

Machinery Wanted

Del., Wilmington — Wilmington Leather Co., 2nd and Greenhill Sts.—machinery and equipment for plant, capacity 1,000 hides per day.

Fla., Clearwater—Bd. Educ.—vocational equipment, including lathes, drill, press, saw, etc., for $160,000 school.

Fla., Tampa — United States Export Chemical Co., c/o Bd. of Trade—machinery and equipment for $1,000,000 plant for the development and manufacture of superphosphate.

Ill., Chicago—H. J. Delson Co., 749 North Western Ave. (job printer and advertising agent)—job press for printing color work.

Ill., Chicago—Wanner Mchy. Co., 716 South Dearborn St., (job printing equipment)—roller proof press.

Ind., Indianapolis—F. W. Young Material Co., 1025 Lewis St.—planing mill, woodworking, transmission and conveying machinery.

Ind., St. Paul—St. Paul Tire & Rubber Co.—tire building machinery and equipment for $200,000 plant.

Ind., Washington—Leonard Range Co., Columbia and Roosevelt Aves.—foundry, assembling, transmission and conveying machinery and equipment.

Ia., Hamburg—L. R. Sims—complete newspaper equipment, including press, belting, hangers, pulleys and shafting.

Ia., Ottumwa—F. O. Parks Scale Co.—electric floor drill, also round stencil machine.

Kan., Seneca—A. Ellis—linotype, newspaper press, metal cutter, etc. (used).

Kan., Topeka—Merit Printing Co., 234 Kansas St., F. B. Brown, Purch. Agt.—newspaper press, linotypes, metal cutter and stereotype outfit.

Ky., Ashland—Ford Block Co.—concrete block making machinery and equipment for $35,000 branch plant near Huntington, W. Va.

Ky., Ivel—Camp Branch Coal Corp., S. R. Jennings, Purch. Agt.—coal mining equipment, including cutting machine, shaker, screens, etc.

Ky., Princeton — Bd. Educ. — vocational equipment, including lathe, drill, press, machine tools, etc., for $110,000 school.

Me., Belfast—School Comn.—machinery for manual training department of proposed $150,000 high school.

Md., Baltimore—M. J. Beach, Calvert Bldg.—machinery and equipment for the manufacture of hollow tile and products.

Mass., Somerville — Fresh Pond Ice Co., 321 Washington St.—conveyors, also ice manufacturing and handling equipment, electrically operated.

Mich., Detroit—F. DeWolf, 1575 Taft Pl.—master woodworking machine or similar outfit and equipment for small shop.

Mich., Paw Paw—Bd. Educ.—complete vocational equipment for $175,000 school.

Mo., Grandin—The Print Shop, Box 27—power job press.

Mo., St. Louis—W. J. Kennedy Stationery Co., 212 North 4th St.—one 14½ x 22 in. job press with complete equipment.

N. J., Matawan—Bd. Educ.—vocational equipment for $130,000 school.

N. J., Peapack—L. A. Zwiller—machinery and equipment for the manufacture of paper products.

N. Y., Ashford—L. Romer—butter and cheese making machinery and equipment.

N. Y., Brockport—Dailey Produce Co.—machinery and equipment for cooperage plant, to replace that which was destroyed by fire.

N. Y., Buffalo—Central Star Laundry, Northland and Masten Sts.—machinery and equipment for addition to laundry.

N. Y., Buffalo—W. H. Ryan, 7 South Ryan St.—acetylene welding outfit.

N. Y., Falconer—Amer. Mfg. Concern—woodworking machinery for proposed $50,000 factory for the manufacture of novelties.

N. Y., Jamestown—Jamestown Chair Co., 20 Winsor St.—additional woodworking machinery and equipment.

N. Y., Jamestown—Jamestown Malleable Products Co., Tiffany Ave.—cast iron and malleable iron foundry equipment, including trip hammers, forges, etc., for addition to plant.

N. Y., Jamestown—Jamestown Wood Finishing Co., East End (manufacturer of paints, fillers, etc.)—machinery and equipment for addition to plant.

N. Y., Johnstown—H. W. Topp Leather Mill—leather dressing machinery and equipment, to replace that which was destroyed by $400,000 fire.

N. Y., Penn Yan—Penn Yan Boat Co., C. Sutherland, Pres.—machinery and equipment for boat factory, to replace that which was destroyed by fire.

N. Y., Rochester — Bliss Plumbing & Supply Co., 47 Andrews St.—complete machinery, tools and equipment for proposed plant at 300 Andrews St.

N. Y., Rochester—Ideal Wet Wash Laundry Co., 13-23 South Water St.—machinery and equipment for laundry, to replace that which was destroyed by fire.

N. Y., Rochester—B. F. Moore, 81 Ellison St.—carpet looms.

N. Y., Rochester—Wegman-Walsh Printing Co., 23 South Water St., E. J. Walsh, Pres.—printing press and equipment.

N. Y., Sinclairville—J. Trusler—blower, forge, drill and other blacksmith shop equipment.

N. Y., Tuxedo (Tuxedo Park P. O.)——R. McCready Co. (woodworking)—saw with movable teeth to cut not less than 6 in., also planer, jointer and variety machine combined.

N. C., Belmont—Art Cloth Mills—looms, spindles and other textile machinery and equipment for $1,000,000 plant.

O., Columbus—Henderson Tire & Rubber Co., Goodall Blvd. along tracks of Hocking Valley Ry., W. O. Henderson, Pres.—tire making equipment, including two vulcanizers, several moulding machines, etc.

O., Columbus—Mechlin Stone Co., Clinton Bldg., M. Mechlin, Pres.—elevating and loading equipment for plant on McKinley Ave.

O., Tiffin—Tiffin Bronze & Brass Co.—foundry equipment.

O., Youngstown—Mahoning Fixtures, 566 Mahoning Ave.—cooling machine,

O., Zanesville—Hubbell Rubber Co., C. C. Hubbell, Pres.—tire making machinery, including vulcanizers, moulders and furnaces.

Okla., Blackwell—Blackwell Job Printing Co.—job folder, 6 x 6 in. to 22 x 30 in., also other printing equipment.

Okla., Picher—Leader Printing Co.—10 x 15 in. power job printing press.

Pa., Allentown—Kerschner Pretzel Bakery, 218 East Susquehanna St.—machinery and equipment for the manufacture of pretzels, to replace that which was destroyed by fire.

Pa., Brownsville—Ehrenpries Tire Sales Co.—repair machinery and equipment for $40,000 tire sales plant.

Pa., Farrell—Pulaski Brewing Co., c/o C. B. Carroll, Mgr.—machinery and equipment for bottling mineral water, also for the manufacture of ginger ale and other soft drink products.

Pa., Farrell—Roccapalumba & Marine, 615 Idaho St.—mechanical refrigeration equipment for wholesale fruit and produce plant at 602 Idaho St.

Pa., Huntingdon—Boyle Ice Co.—ice manufacturing machinery and refrigeration equipment for $85,000 plant.

Pa., Lucinda—Lucinda Refining Co.—machinery, tools and equipment, including transmission and conveying machinery, for proposed $75,000 refinery.

Pa., New Castle—Consumers Ice Co.—ice manufacturing machinery and refrigeration equipment for proposed large plant.

Pa., Reading—Penn Planing Mill, Grape and 2nd Sts.—complete planing mill machinery and equipment.

Pa., Scranton—B. Mardossian, 110 Penn Ave.—Hoffman pressing machines.

Pa., Warren—Newell Press, 244 Pennsylvania Ave.—printing presses, controllers, transmission and conveying machinery, etc., for proposed $50,000 printing plant.

Pa., Wilkes-Barre—Lehigh & Wilkes-Barre Coal Co., Lehigh & Wilkes-Barre Bldg.—machinery and equipment for development of extensive coal lands near Green Mountain.

Tex., Copperas Cove—J. Downey—power paper cutter, paper perforator and job printing press.

Tex., Fort Worth—United States Government, Wash., or c/o A. G. Olson, Commander, Decatur Rd.—machinery for additions to helium plant.

Tex., Mineral Wells—Palo Pinto Oil & Refining Co.—machinery and equipment, including transmission and conveying machinery, etc., for $75,000 addition to oil refinery.

Tex., Paris—C. R. Walther (cabinet worker)—Universal woodworker.

Va., Ashland—Burgess Bros. (job printers)—cutting knife and large job press.

Va., Ashland—L. Jones—small lathe and drill press for woodworking.

Va., Richmond—MacCosby Auto Service Co., 15 West Grace St.—air compressor, also vulcanizing molds and plates.

Va., Richmond—M. Rosenthal Printing Co., 412 East Main St.—large cylinder printing press.

Va., Richmond—Younglove Body Wks., 310-12 Henry St.—bandsaw for woodwork.

Va., Winchester—J. H. Lockhart (lumber)—lathes and belting.

W. Va., Fairmont — Fairmont-Chicago Coal Co.—complete machinery and equipment for $100,000 coal tipple.

W. Va., Killarney—Killarney Smokeless Coal Co.—electric coal mining machinery and equipment, including transmission and conveying machinery.

Wis., Black River Falls—Jackson Box Co., c/o W. B. Schofield (manufacturer of boxes, also general woodworking)—20 to 30 in. bandsaw.

Wis., Columbus — Chisholm-Scott Viner Co.—special machinery, belting and shafting for proposed $45,000 factory for the manufacture of pea viners.

Wis., Evansville—H. F. Brunselle — coal handling machinery, cranes, hoists and conveyors for coal storage elevators.

Wis., Fond du Lac—J. Grebe, 22 Rees St.—gasoline storage tank and pump for proposed $40,000 garage.

Wis., Milwaukee—C. J. Harp, 965 35th St. (carpentry and millwork)—crosscut and rip saws, also planer, about 3 in.

Wis., New Diggings—Winrock Mining Co. —machinery and equipment for new seven cell wet mill, including crushers, conveyors, shafts and belting.

Wis., Racine—Amer. Skein & Fdry. Co., 23rd and Racine Sts.—equipment, including cupola and pouring ladles, for proposed $40,000 foundry.

Wis., Sheboygan—J. Herziger, 1326 Superior Ave.—grinding and cutting machinery, belting, shafting, ice machine and refrigeration equipment for proposed sausage factory.

Wis., Waupaca—Rasmussen-Eble Gravel Co., J. P. Rasmussen, Purch. Agt.—heavy duty stone crushing and loading machinery.

Wis., Wauwatosa—C. Lutzen, 227 Harvey Ave. (carpentry and woodworking)—medium size planer, also band saw, about 20 in.

Wyo., Casper—White Eagle Oil & Refining Co.—machinery and equipment for proposed $55,000 refinery.

Ont., Bothwell—Tunks Bros., Ltd., R. H. Tunks, Purch. Agt.—complete equipment for basket making plant.

Ont., Pembroke — Edwards Lumber & Pulp Co., Ltd., W. R. Beatty, Secy.—equipment to increase capacity of sawmill from 20,000,000-25,000,000 ft. to 35,000,000-40,000,000 ft. per year; later, machinery for pulp and paper mill.

Ont., Schumacher — McIntyre-Porcupine Mines—hoisting equipment, crushers, tube and ball mills, also cyanide apparatus, electric power.

Ont., Timmins — McIntyre-Porcupine Mines, Ltd.—machinery and equipment for proposed ore mill near Pearl Lake.

Que., Grand Mere—J. Rhault, Ste. Flore St.—additional machinery for the manufacture of sash and doors.

Que., Montreal—Hanley Clarke Lumber Co., Ltd., c/o B. Robinson, 120 St. James St.—equipment for sawmill and shingle mill.

Que., Montreal—Mulhollin Co., Ltd., 786 St. Catherine St., W., R. Mulhollin, Purch. Agt.—machine for burning carbon and soldering.

Que., Ste. Thecle—O. Cossette—additional forges and other blacksmith shop equipment.

Que., Three Rivers—Bellefeuille & Freres, 277 Notre Dame St., A. Bellefeuille, Purch. Agt.—foundry equipment.

Metal Working Shops

Calif., Merced—The Merced Union High School Dist. is having plans prepared for the construction of a 40 x 120 ft. machine shop and auditorium, 1,000 seating capacity. Cost will exceed $50,000. Allison & Allison, Hibernian Bldg., Los Angeles, Archts.

Calif., Oakland—The California Fdrys., Inc., 950 19th Ave., is having plans prepared for the construction of an addition to its foundry. Estimated cost $6,000. R. V. Woods, 505 17th St., Oakland, Archt.

Calif., Redwood City—The Gogle Hand-Forged Tool Co., 1941 Polk St., San Francisco, awarded the contract for the construction of a 1 story factory, here. Estimated cost $12,000. Noted June 14.

Conn., East Hartford (Hartford P. O.)—McKinley Bros., 809 Main St., are having plans prepared for the construction of a 1 story, 100 x 200 ft. garage and show room on Main and Gaivan Sts. Estimated cost $50,000. W. F. Brooks, Lewis and Gold Sts., Hartford, Archt.

Conn., West Hartford (Hartford P. O.)—Prospect Garage, Prospect Ave., is having plans prepared for the construction of a 1 story, 100 x 100 ft. garage. Estimated cost $40,000. B. A. Sellew, 721 Main St., Hartford, Archt.

Ill., Chicago—L. G. Hallberg & Co., Archts., 116 South Michigan Ave., are receiving bids for the construction of a 6 story, 217 x 241 ft. addition to factory on Lincoln and George Sts. for the Stewart-Warner Speedometer Co., 1312 South Michigan Ave. Estimated cost $750,000.

Ill., Chicago — C. Mothan, 1316 South Troy St., awarded the contract for the construction of a 1 story, 100 x 125 ft. garage on 48th St. and Cottage Grove Ave. Estimated cost $40,000.

Ill., Chicago—The Olson Cartage Co., 525 West Chicago Ave., awarded the contract for the construction of a 1 story, 95 x 125 ft. garage at 417-21 West Chicago Ave. Estimated cost $40,000.

Ill., Chicago—The Yellow Cab Mfg. Co., 5801 Dickens Ave., awarded the contract for the construction of a 3 story, 200 x 347 ft. factory at 5918-48 Armitage Ave. Estimated cost $300,000.

Kan., Kansas City — The Darby Boiler Wks. Co., 923 North 3rd St., has had plans prepared for the construction of Part B, 1 story, 400 x 600 ft. factory. Estimated cost $100,000. Private plans.

Ky., Louisville—The Standard Sanitary Mfg. Co., 6th and A Sts., manufacturer of plumbers' supplies, awarded the contract for the construction of two 1 story, 102 x 150 ft. and 56 x 75 ft. foundry buildings on 6th and Shipp Sts. Estimated cost $70,000.

Mass., Cambridge — The Essex Brass Fdry. Co. plans to build a 2 story brass foundry on 1st St. Estimated cost $100,000. A. Morang, Mgr. Engineer or architect not selected.

Mass., Lowell—The Saco-Lowell Co., Dutton St., awarded the contract for the construction of a 1 story, 40 x 100 ft. forge shop. Estimated cost $30,000. Noted May 24.

Mass., Ware—The Ware Fdry. Co. plans to rebuild the part of its foundry which was destroyed by fire. Estimated cost, including equipment, $20,000. F. G. Quinn, Mgr.

Mass., Worcester—Rice, Barton & Fales Machine & Iron Co., Taintor St., awarded the contract for the construction of a 1 story, 40 x 140 ft. foundry. Estimated cost $40,000.

Mich., Detroit—The Detroit Motorbus Co., Terminal and Edlie Aves., awarded the contract for the construction of a 1 story garage on Tireman Ave. Estimated cost $75,000.

Mich., Menominee—The Lloyd Mfg. Co., North State St., awarded the contract for the construction of a 3 story, 100 x 400 ft. factory for the manufacture of baby carriages. Estimated cost $75,000. Noted June 7.

Minn., Minneapolis—C. F. Haglin & Sons Co., 226 Lumber Exchange, will build a 2 story, 135 x 170 ft. warehouse and a 1 story, 100 x 170 ft. garage on Laurel Ave. near Bryant Ave.

Minn., Minneapolis—G. Lindley, 622 Nicollet Ave., awarded the contract for the construction of a 1 story garage at 1415 Hennepin Ave. Estimated cost $45,000.

Mo., Kansas City—The W. Jewell Realty Co., 227 Rialto Bldg., will build a 2 story, 110 x 132 ft. garage at 912-922 Cherry St. Estimated cost $65,000.

Mo., St. Louis—The Tate Motor Co., Inc., 3111 Locust St., has purchased site and plans to build a 3 story, 125 x 165 ft. garage and automobile showroom, including repair and parts departments, on Washington St. Estimated cost $300,000. Engineer or architect not announced.

N. Y., Brooklyn—H. Beskin, c/o B. W. Dorfman, Engr. and Archt., 26 Court St., will build a garage on East 15th St. Estimated cost $35,000.

N. Y., Brooklyn—M. Catalbiano, c/o T. Goldstone, Engr. and Archt., 50 Graham Ave., is having plans prepared for the construction of a 1 story, 100 x 100 ft. garage on DeKalb Ave. Estimated cost $60,000.

N. Y., Brooklyn—P. Cleary, c/o L. A. Sheinert, Engr. and Archt., 194 Bowery, New York City, is having plans prepared for the construction of a 1 story, 100 x 125 ft. garage on Coney Island Ave., here. Estimated cost $70,000.

N. Y., Brooklyn—The Esthetic Realty Co., c/o Seelig & Fenkelstein, Engrs. and Archts., 44 Court St., will build a 1 story, 100 x 120 ft. garage on 6th St. Estimated cost $35,000.

N. Y., Brooklyn—S. Holland, c/o E. M. Adelsohn, Engr. and Archt., 1778 Pitkin Ave., has had plans prepared for the construction of a 1 story, 100 x 200 ft. garage on Liberty Ave. and Wyona St. Estimated cost $50,000.

N. Y., Elmira—The Standard Oil Co. of New York City, 26 Bway., has purchased site and plans to build a garage, machine shop and service station on Lake, 5th and William Sts., here. Estimated cost $50,000. A. E. Carr, 1001 Stowell St., Local Mgr.

N. Y., Fonda—The Standard Oil Co. of New York, 26 Bway., New York City, has purchased site and plans to build a garage, warehouse, tanks, pipe lines and office building on West Main St., here. Estimated cost $250,000.

N. Y., Jamestown—The Jamestown Metal Desk Co., Blackstone Ave., awarded the contract for the construction of a 1 story addition to its factory. Estimated cost $50,000. Noted May 10.

N. Y., New York—The Bd. Educ., 500 Park Ave., has had plans prepared for the construction of a 4 story garage on Brook Ave. Estimated cost $350,000. W. H. Gompert, Flatbush Ave. Extension and Concord St., Brooklyn, Engr. and Archt.

N. Y., New York—The Edes Garage, Inc., c/o L. A. Sheinart, Engr. and Archt., 194 Bowery, will build a 1 story garage on West Farms Rd. Estimated cost $60,000.

N. Y., New York—J. E. Eustis, c/o S. Rosenblum, Engr. and Archt., 51 Chambers St., will soon receive bids for the construction of a 2 story, 125 x 165 ft. garage on Fordham Rd. Estimated cost $85,000.

N. Y., New York—H. Mitchell, c/o J. J. Dunnigan, Engr. and Archt., 394 East 150th St., has had plans prepared for the construction of a 2 story, 115 x 120 ft. garage on East 172nd St. Estimated cost $85,000.

N. Y., New York—D. Salvato, c/o D. Clark, Engr. and Archt., 441 East Tremont Ave., has had plans prepared for the construction of a 1 story, 110 x 115 ft. garage on Morris Ave. Estimated cost $50,000.

N. Y., New York—The W. C. P. Realty Co., c/o W. Shary, Engr. and Archt., 41 Union Sq., will build a 2 story, 100 x 125 ft. garage at 418 East 48th St. Estimated cost $50,000.

N. Y., Rochester — The Genesee Bridge Co., 666 Plymouth Ave., plans to build a structural steel working plant on West Ave. Cost will exceed $55,000. D. Hershey, Mgr. Engineer or architect not announced.

O., Canton—The Canton Metal Products Co., c/o F. A. Zink, Renkert Bldg., plans to build a 1 story factory for the manufacture of metal products for automotive industries.

O., Cincinnati—The Hauser Stander Tank Co., Ammen St. along tracks of Baltimore and Ohio R.R., awarded the contract for the construction of a 1 story, 90 x 120 ft. addition to its factory. Estimated cost $50,000.

O., Cleveland—The Amer. Can Co., 1677 East 40th St., has had plans prepared for alterations and the construction of a 1 story, 42 x 55 x 127 ft. addition to its factory at 1588 East 40th St. Estimated cost $40,000. H. C. Meyer, Supt. C. G. Preis, 120 Bway., New York City, Archt.

O., Cleveland—Benesch, Federman & Co., 5432 Bway (furniture), awarded the contract for the construction of a 2 story, 50 x 60 ft. garage and warehouse at 5316 Barkwill Ave. Estimated cost $40,000.

O., Cleveland—The Brodhead-Garrett Co., 2835 East 51st St. (hardwood lumber), awarded the contract for the construction of a 1 story, 300 x 360 ft. warehouse, 40 x 40 ft. dry kiln, 40 x 50 ft. planing mill, boiler house, office and garage on East 71st St. along tracks of Belt Line R.R. Estimated cost $150,000. J. C. Rash, Asst. Secy. Noted May 3.

O., Cleveland—J. J. Klein and G. B. Harris, Engineers Bldg., will soon award the contract for the construction of two 2 story, 75 x 100 ft. and 80 x 110 ft. automobile sales and service buildings at 6604 Euclid Ave. Estimated cost $150,000. W. S. Longee, Marshall Bldg., Cleveland, Archt. Noted Apr. 19.

O., Cleveland — The Lees-Bradner Co., 6210 Carnegie Ave. (gear cutting), is having plans prepared for the construction of a 1 story, 55 x 100 ft. machine shop and a 30 x 100 ft. storage building. Estimated cost $60,000. E. J. Lees, Pres. W. J. Wefel, 225 Union Bldg., Cleveland, Archt.

O., Cleveland—J. Miller, 2701 East 55th St. (trucking), awarded the contract for the construction of a 1 story, 85 x 140 ft. garage at 2966 East 55th St. Estimated cost $45,000. Noted June 7.

O., Cleveland — The Surety Investment Co., 16112 Euclid Ave., awarded the contract for the construction of a 1 story, 75 x 120 ft garage at East 105th St. and Hampden Ave. Estimated cost $50,000. Rosen Garage Co., 5618 Woodland Ave., Cleveland, lessee.

O., Dayton—The Duro Pump & Mfg. Co., 537 East Monument St., is having plans prepared for the construction of a 5 story, 100 x 100 ft, factory for the manufacture of pumps. Estimated cost $175,000. Schenk & Williams, Mutual Home Bldg., Dayton, Archts. Noted Jan. 18.

O., Ironton—The Ironton Stove & Mfg. Co. plans to build two additions to its plant, to be used for foundry and enameling departments.

O., Massillon—The Central Steel Corp., c/o C. G. Herbruck, G. D. Harter Bank Bldg., plans to build blast furnaces and auxiliary steel plant units on Columbia Heights. Cost between $7,000,000 and $10,000,000. F. J. Griffiths, Genl. Mgr.

O., Toledo—The United States Malleable Iron Castings Co., Woodville St. along tracks of Bay Terminal Ry., is rebuilding its plant, which was destroyed by fire. Estimated cost less than $100,000.

Pa., Altoona—The Altoona Factories Co., c/o D. J. Howard, Chamber of Commerce, Secy., is having plans prepared for the construction of a 3 story, 90 x 120 ft. factory for the manufacturer of automobiles on Industrial Ave. Estimated cost $150,000. W. A. Hoyt, Hutchison Bldg., Altoona, Archt. Dixon Motor Truck Co., 2501 Beale Ave., Altoona, lessee.

Pa., Canonsburg—J. Hoxworth awarded the contract for the construction of a 1 story (ultimately 2 story), 65 x 138 ft. garage on Greenside and Pike Sts. Estimated cost $40,000.

Pa., Ferndale—The Trabold Motor Co., Railroad St., Johnstown, plans to build a 2 story, 90 x 220 ft. plant with power room, for the manufacture of automobile trucks, on Clay and Ferndale Sts., here. Estimated cost $100,000. A. Trabold, Pres.

Pa., Johnstown—E. Robinson, Pres. of the Robinson Motor Car Co., 212-218 Main St., is receiving bids for the construction of a 3 story, 66 x 140 ft. garage. Estimated cost $80,000. H. M. Rogers, Trust Bldg., Johnstown, Archt.

Pa., Pitcairn—The Pennsylvania R.R., Central Region, Broad St. Sta., Phila., awarded the contract for the construction of a 1 story, 42 x 90 ft. boiler, machine and transformer shop, here.

Tex., Dallas — Sutton, Steel & Steele, Forney Ave. ,awarded the contract for the construction of a 1 story, 40 x 80 ft., 30 x 100 ft. and 60 x 150 ft. foundry building. Estimated cost $125,000. Noted May 3.

Tex., San Angelo—R. P Amacker, South Chadbourne St., has had plans prepared for the construction of a 2 story garage. Estimated cost $40,000. A. R. Swartz, Trust Bldg., San Angelo, Archt.

Wis., Appleton—The Valley Automobile Co., 726 College Ave., plans to build a 4 story garage on Morrison St. Estimated cost $60,000. Engineer or architect not selected.

Wis., Fond du Lac—Stepnoski & Mehner, Archts., Forest Ave., are receiving bids for the construction of a 1 story, 56 x 100 ft. garage for J. Grebe, 22 Rees St. Estimated cost $40,000.

Wis., Gillett—Miller & Rehme, c/o E. Rehme, will build a 1 story, 50 x 100 ft. machine shop. Estimated cost $30,000.

Wis., Green Bay—Foeller, Schober & Stephenson, Archts., Nicollet Bldg., are receiving bids for the construction of a 1 and 2 story, 62 x 159 ft. garage on Main St. for the Beaumont Hotel, Main and Washington Sts. Estimated cost $45,000.

Wis., Hilbert—C. F. Lawler awarded the contract for the construction of a 1 and 2 story, 46 x 80 ft. garage and repair shop. Estimated cost $40,000.

Wis., Madison—W. Brueske, 2508 East Washington Ave., is receiving bids for the construction of a 2 story, 50 x 90 ft. garage and repair shop. Estimated cost $40,000. Private plans.

Wis., Madison—The Capitol City Garage, South Pinckney St., awarded the contract for the construction of a 2 story, 66 x 165 ft. garage on Washington St. Estimated cost $75,000. A. Hult, Pres. Noted May 24.

Wis., Madison — The Chicago & Northwestern Ry., 226 West Jackson St., Chicago, awarded the contract for the construction of a 1 story, 100 x 250 ft. roundhouse, repair pits, etc., here. Estimated cost $300,000.

Wis., Madison—The Madison Nash Co., 155 East Wilson St., is having plans prepared for the construction of a 2 story, 66 x 12 ft. garage and repair shop. Estimated cost $40,000. Claude & Starck, Badger Annex, Madison, Archts. Noted May 24.

Wis., Madison—Schmidt Bros. Co., c/o A. J. Schmidt, 2611 Monroe St., is receiving bids for the construction of a 1 story, 60 x 125 ft. garage and repair shop. Estimated cost $40,000. Private plans.

Wis., Milwaukee—The Milwaukee Lumber Co., 1271 Midland Ave., is having plans prepared for the construction of a 2 story, 30 x 100 ft. garage. Estimated cost $40,000. Gurda & Gurda, 448 Mitchell St., Milwaukee, Archts.

Wis., Racine—F. Applegate, 1043 Washington Ave., is having plans prepared for the construction of a 1 story, 60 x 105 ft. garage and repair shop. Estimated cost $55,000. Private plans.

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